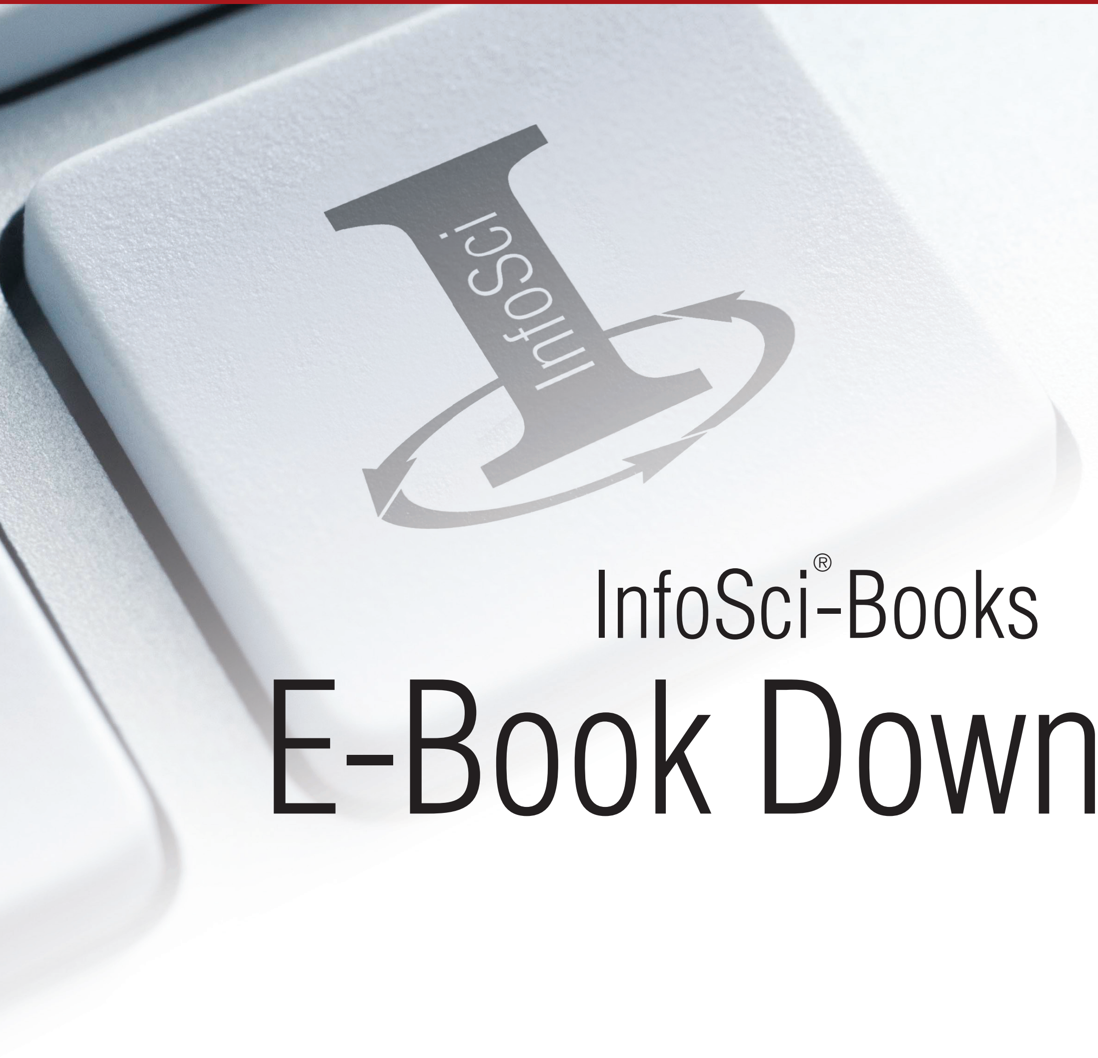

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G. David Garson
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Preface

The readings that compose this volume are intended to constitute a survey of many of the most important dimensions of managing information technology in the public sector. This work updates and replaces an earlier volume, *Information Technology and Computer Applications in Public Administration: Issues and Trends* (Idea Group Publishing, 1999). All contributions to the present volume have been substantially revised and updated, and three entirely new chapters replace outdated topics. Essays in Part I address general policy and administrative issues in this arena, while those in Part II are more applied and address information technology skills needed by public managers. Taken together, it is hoped that a contribution is made by these essays toward the knowledge and competencies needed by graduate students of public administration and by practitioners new to this field.

PART I: MANAGING INFORMATION TECHNOLOGY IN THE PUBLIC SECTOR

In "Information Technology and Public Administration: The View from the Profession," Alana Northrop points out the need for a reader on information technology by reviewing the importance given computing education by MPA programs and practitioners. A survey of leading public administration journals finds general neglect of coverage of computing. Textbooks in the field also barely mention information technology. The chapter suggests that there are six generic skills that need to be taught in public administration curricula, with a seventh one on the horizon.

In "Politics, Accountability, and Governmental Information Systems," Bruce Rocheleau discusses how central political issues are to information management and illustrates strategies that can be useful in dealing with political issues. Examples are given of how inattention to the political aspects of managing information systems can result in problems and even disasters. Internally, information managers have to deal with such politically-charged tasks as the structuring of information management, purchasing information systems, managing personnel in this era of digital communication, and struggles over the sharing of information within organizations. External information management issues include demands for online accountability information, the development of websites, issues over access to information, and interorganizational issues including disputes over turf.

In "The Evolution of Information Technology Management at the Federal Level: Implications for Public Administration," Stephen H. Holden finds that despite some maturation in the literature for managing IT in federal agencies in the last several years, public administration has contributed little to this effort. His chapter analyzes federal IT management literature from several academic disciplines and government documents. The analysis compares federal IT management with a normative model of management maturity, focusing on the strategic objectives for IT and related management approaches. Public administration's minimal contribution to federal IT management raises profound questions, he argues, whether federal agencies are performing commensurate with public expectations in an information age.

In "The Realities of the Paperwork Reduction Act of 1995: A Government-Wide Strategy for Information Resources Management," Patricia Diamond Fletcher discusses the strategic management practices required for the use of information and information technologies under the Paperwork Reduction Act of 1995, including electronic government initiatives, homeland security, federal workforce retention problems, and inter/intra-governmental agency data sharing programs and systems. The PRA sets the policy agenda for information resources management in the U.S. federal government and places the guidance and oversight for enacting the PRA in the Executive Office of Management and Budget (OMB). At both levels of guidance and practice, the PRA has had mixed success, since it was initially signed into law in 1980. Fletcher argues that the OMB has not met its statutory responsibilities under the PRA and the federal government is left without a cohesive direction and agenda for information resources management.

In "Mediating the Tension between Information Privacy and Information Access: The Role of Digital Government," George T. Duncan and Stephen F. Roehrig find that advances in information technology, particularly the Internet, have multiplied the tension between demands for evermore comprehensive databases and demands for the shelter of privacy. In mediating between these two conflicting demands, agencies must address providing access to information while protecting confidentiality, coping with health information databases, and ensuring consistency with international standards. The technical procedures for disclosure limitation involve a range of mathematical and statistical tools. The administrative procedures can be implemented through a variety of institutional mechanisms, ranging from privacy advocates, through internal privacy review boards, to a data and access protection commissions.

Rounding out Part I, in “E-Government: An Overview,” Shannon Howle Schelin surveys the rapid growth of e-government. Her essay offers an overview of the historical premises, theoretical constructs, and associated typologies of e-government. These typologies posit a framework for understanding e-government, its potential benefits, and its related challenges.

PART II: COMPUTER APPLICATIONS IN PUBLIC ADMINISTRATION

In “Leading Edge Information Technologies and American Local Governments,” Donald F. Norris examines the adoption, penetration and impacts of the adoption of leading edge information technologies in American local governments using data from three nationwide surveys of information technology in local governments and a series of case studies in US cities about the adoption of leading edge information technologies. His principal findings are that American local governments have adopted a range of these technologies and can be expected to do so in coming years, especially in the area of adoption of electronic government.

In “Information Technology as a Facilitator of Results-Based Management,” James E. Swiss discusses IT in relation to results-based management, which encourages planning and target setting to make the organization more proactive; an emphasis on outcomes to make the organization better focused on its mission; quick performance feedback to make the organization more responsive; and continuous process improvements to make the organization better able to serve its clients. These changes are possible only with supporting information technologies, including GIS, EIS, and intranets. Swiss notes, however, that IT can increase management effectiveness only if its role has been carefully designed. Public managers must determine such policy issues as what information would best guide upcoming major decisions; what balance the agency wishes between internal information accessibility versus security; and how best to balance frontline worker empowerment versus the need for organizational uniformity.

In “Computer Tools for Better Public Sector Management,” Carl Grafton and Anne Permaloff survey the wide variety of computer applications routinely used to assist in public management, including word processing, spreadsheet, statistics, database management programs, web authoring software, presentation graphics, optical character recognition (OCR), project planning, and management software as illustrations of the diversity in widespread use.

In "Survey Research, Focus Groups, and Information Technology in Research and Practice," Michael L. Vasu and Ellen Storey Vasu discuss electronic tools for citizen surveys and the integration of computing into survey research and focus groups in research and practice in public administration. Their chapter reviews uses of computers in computer-assisted information collection (CASIC), computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), and transferring survey research methods onto the Web. A second portion of the chapter gives special attention to continuous audience response technology (CART), using as an example a citizen survey focused on economic growth issues.

In "Geographic Information Systems in the Public Sector," T. R. Carr and John D. Burroughs discuss what has been the fastest-growing application of information technology in the public sector outside of e-government itself. Geographic information systems have emerged as significant decision-making tools, and Carr and Burroughs discuss their application at both the planning level and at the management decision-making level. Issues impacting GIS implementation include needs assessment, project planning, access to public records, liability issues, public and private partnerships, dissemination of information, and privacy issues.

In "Electronic Mail in the Public Workplace: Issues of Privacy and Public Disclosure," Charles L. Prysby and Nicole D. Prysby survey the legal questions concerning e-mail in public institutions and agencies. These include both issues of employee privacy regarding e-mail messages and public access to e-mail under applicable freedom of information legislation. While the employer has broad legal grounds for reading workplace e-mail, employees frequently feel that such monitoring is an excessive invasion of their privacy, resulting sometimes in organizational conflict over privacy issues. State laws vary considerably in terms of how they define the types of e-mail messages that are part of the public record, some being far more inclusive than others. Given the uncertainty and confusion that frequently exist regarding these legal questions, it is essential that public organizations develop and publicize an e-mail policy that both clarifies what privacy expectations employees should have regarding their e-mail and specifies what recording keeping requirements for e-mail should be followed to appropriately retain public records.

In "World Wide Web Site Design and Use in Public Management," Carmine Scavo explores the promise and reality of governmental web applications, including bulletin board applications, promotion applications, service delivery applications, and citizen input applications. A survey of 145 municipal and county government websites originally conducted in 1998 was replicated in 2002. These data are used to examine how local governments are actually using the web and to examine the evolution of web usage. The chapter concludes that local governments have made progress in incorporating many of the features of the Web but that they have a long way to go in realizing its full promise.

Finally, in "Toward an Information Technology Research Agenda for Public Administration," G. David Garson outlines research questions which form the dimensions of a research agenda for the study of information technology in public administration. The dimensions selected as being the most theoretically important include the issue of the impact of information technology on the distribution of power; the issue of information resource equity and the "digital divide"; the issue of the use of IT as symbolic action; the issue of the impact of IT on discretion; the issue of the impact of IT on organizational culture; the issue of privatization; the issue of decentralization; the issue of remote work; the issue of implementation success factors; the issue of persuasiveness of governmental websites; the issue of regulation of social vices mediated by IT; and selected other regulatory issues.

G. David Garson
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Part I

Managing Information Technology in the Public Sector

Chapter I

Information Technology and Public Administration: The View from the Profession

Alana Northrop
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ABSTRACT

This chapter first points out the need for a reader on information technology by reviewing the importance given computing education by MPA programs and practitioners. Next, the chapter surveys current textbooks' and general public administration journals' treatments of the topic. Three highly respected public administration journals and six textbooks are reviewed. The journals are found to barely treat the topic of computing, whether as a main focus or as merely a mention in articles. The textbooks also barely mention computing. In addition, there is no consistent rubric or chapter topic under which computing is discussed. The need for a reader on information technology and computer applications in public administration is apparent. The chapter then turns to the consideration of what hands-on skills in computer applications should be a mark of a graduate degree in public administration. It is suggested that there are six generic skills with a seventh one on the horizon. Finally, the chapter concludes by briefly discussing a range of issues that public administrators should be conversant with if they are to successfully utilize computer applications in the delivery of public sector services.

INTRODUCTION

In 1985, a special computing education committee recommended to the National Association of Schools of Public Affairs and Administration (NASPAA) that a sixth skill, computing, be added to the original five skills that must be taught in an MPA Program. This recommendation applied to the accreditation of schools starting in 1988. Now almost twenty years have passed since the original recommendation. Let us turn to evaluate the progress that has been made.

COMPUTING EDUCATION IN MPA PROGRAMS

There have been two published studies that surveyed MPA programs and assessed the level of computing education. Cleary (1990) mailed out questionnaires to 215 public affairs/public administration masters programs affiliated with the National Association of Schools of Public Affairs and Administration (NASPAA) in 1989. Of the 80 percent returned, about one out of four reported that they had a course dealing with information systems/computer skills. The respondents were quick to note that the information systems/computer skill area needed more attention in the future. Yet, 1989 was a long time ago, especially when it comes to the massive changes in the computer field.

Brudney, Hy, and Waugh (1993) did a little more recent survey of MPA programs. Close to 90 percent of the programs said they use computers in their instruction. Over half of the institutions offer a course in computers, yet only 30 percent had made computing a requirement. The study also suggested that computing skills need to be taught beyond the typically taught statistical applications.

Without an absolutely current survey of programs, one can only surmise, pretty safely, that computer use in MPA courses has greatly expanded. But what skills and management issues should be taught?

WHAT PA PRACTITIONERS ADVISE IN COMPUTING EDUCATION

Four studies surveyed public managers. Lan and Cayer (1994) surveyed administrators in one state. The recommendations were that MPA programs need coursework in computer literacy, specifically knowledge of applications and hands-on skills. The respondents said they use information technology (unfortunately this includes phone and fax) on an average of 56 percent of their day. The respondents also said that they were involved with the management of the information system, so management issues as well as computer skills are important for PA students.

Crewson and Fisher (1997) surveyed 371 city administrators in the US. In terms of importance for public administrators in the future, 37 percent of the sample rated computer skills as most important with 57 percent giving such skills moderate importance. Similar ratings were given by the sample to knowing about computers.

An earlier study (Poister & Streib, 1989) of 451 municipal managers indicates the extensive diffusion of management information systems in the 1980s. Other indications of computer use can be obliquely inferred from usage of such management tools as revenue forecasting and performance monitoring.

A 1988 study of 46 technologically advanced cities was intended to predict the "common state" of computerization in US cities in the late 1990s (Kraemer & Northrop, 1989). That study indicated that no city department or staff role was spared from the diffusion of computers. In fact, 84 percent of managers responding and 85 percent of staff respondents indicated that their work involved major interaction with computers.

In essence, even taking into account that these studies are out-of-date, the word from public managers is to know how to use computers and be ready to deal with management issues surrounding computerization.

COMPUTING EDUCATION IN PUBLIC ADMINISTRATION JOURNALS AND TEXTBOOKS

We know there is a need for computing education in MPA programs, as practitioners and both the 1985 recommendation and 1989 update pointed out (Kraemer & Northrop, 1989; NASPAA Ad Hoc Committee on Computers in Public Management Education, 1986). Yes, schools say they have integrated computing into their curriculum (Brudney, Hy, & Waugh, 1993). But how has the field of public administration pushed computing education in print?

One way to answer that question is to review research and textbooks in public administration. This third approach to looking at computing education is based on the theory of triangulation. Triangulation means using different data sources trained on the same problem, in this case computing education. Triangulation not only involves using data from different sources but also from different perspectives. In this section the sources are general public administration journals and textbooks. The different perspective is the belief that one can learn about computing education not just from what university program directors say they teach but also from looking at the published sources of information commonly available to public administration academics and professionals.

Professional Public Administration Articles

The journals were selected based on Forester and Watson's (1994) survey of all editors and editorial board members of 36 journals who mention public administration in general or public administration topics, such as personnel and finance, in their mission statements. The study used a 10-point scale, 10 representing the best journal in the field according to the respondents, a 0 indicating no respondent rates that journal in the top ten. The top five general public administration journals, whether you include or exclude the board members of those journals in the rankings are listed in the table below.

In deciding which journals to evaluate, the quality of the journal was considered as well as the requirement that the journal be recognized as one that

	All Respondents	Minus Board Members
Public Administration Review	8.34	8.19
Administration & Society	5.36	5.17
American Review of Public Administration	3.85	3.40
Journal of Public Administration Theory	3.20	2.78
Public Administration Quarterly	2.88	2.45

NOTE: There is a very clear drop-off in ratings for journals rated lower.

dealt with the field of public administration in general. The latter requirement was based on the recommendation of the 1985 NASPAA committee that the computing topic be integrated into all courses versus segregated into one or a part of one course. Thus, the computing topic should be relevant to all academics and practitioners interested in public administration, not just those in a particular specialized area. The quality issue obviously speaks to the dissemination of information as well as the importance of computing as demonstrated by its acceptability as a topic in esteemed publishing outlets.

Clearly, *Public Administration Review* (PAR) and *Administration & Society* (A&S) stand out as the top general public administration journals and, in fact, as the top public administration journals, period (Forester & Watson, 1994). We also felt that *American Review of Public Administration* (ARPA) should be selected. Although it is closer in ratings to other lower ranked journals than it is to the two leaders, it stands out in its ratings' gap from the lower journals more than it is similar to them in ratings' differences.

Table 1 shows how often computing appeared as a topic in the three selected journals over the last ten years. There is no trend. Articles that mention computing or have computing as the main focus are rare, with no decided increase over time. It should also be noted that articles that mention computing might involve as little as a one-sentence mention in the whole article.

PAR is obviously the main outlet for such articles of the three journals examined. Still assuming about 8 articles per issue, less than 5 percent of the regular issue articles in PAR have dealt with computing. About 2 percent of articles published in A&S and ARPA since 1992 have dealt with computing to any degree. Of note is that in 1986, PAR published a special issue with 14 articles on computing issues.

In sum, while the academic field and the world of government practice increasingly recognize the importance of computing, the research world in terms of top quality journals does not.

Table 1. Appearance of Computing Topic in Public Administration Journals

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*
Administration & Society										
Number of articles that mention computing	0	0	0	0	0	0	0	0	0	0
Number of articles in which main focus is computing	0	1	0	0	0	1	1	1	1	1
American Review of Public Administration										
Number of articles that mention computing	0	0	1	0	0	1	0	1	1	0
Number of articles in which main focus is computing	0	0	1	1	0	0	1	0	0	3
Public Administration Review										
Number of articles that mention computing	1	0	0	0	2	4	2	0	0	1
Number of articles in which main focus is computing	1	1	2	2	2	0	1	0	1	2
Totals										
Number of articles that mention computing	1	0	1	0	2	5	2	1	1	1
Number of articles in which main focus is computing	1	2	3	3	2	1	4	1	2	6
Number of articles that mention computing or in which main focus is computing	2	2	4	3	4	6	6	2	3	7

The problem may be that only a few researchers or universities are interested in the topic. Of the 38 articles even somewhat dealing with computing noted in Table 1, authors represent a great variety of universities in a variety of states. In addition, a handful of authors were government employees. Moreover, all regions of the country except the Great Plains appear to be represented by the authors. Thus, it is not the case that computing as a research area is the publishing province of only a few universities in a handful of states.

Public Administration Textbooks

Professional public administration journal articles are a common outlet for academics and professionals to keep up on the latest research and trends in the field. Articles can be assigned in class or incorporated into lectures. Another common outlet on what is essential to the public administration field is textbooks. While one can "avoid" keeping up by not reading all journal articles, it is hard not to read the books assigned in class on both the professor's and student's sides. So if one were seeking to learn about the essential topics in the field of public administration, what would you learn by reading the textbooks?

In this instance, we looked at how often computers or information systems were mentioned in current public administration textbooks. Three of the texts were chosen since they were used in an earlier study (Bingham & Bowen, 1994) and were still in active printing (Rosenbloom & Kravchuck, Denhardt, & Henry). Stillman's (2000) textbook was added, given its long history as a

Table 2. Appearance of Computing Topic in Public Administration Textbooks

Textbook Name and Author	*Number of pages Mentioning Computers or Information Systems and Percentage*[a]	*Name of Chapter in Which Pages Appear*			
		Finance	Information Technology	Decision-making	Other
Public Administration Concepts and Cases by Stillman (2000))	0 (0)				
The Craft of Public Administration by Berkeley and Rouse (2000)	3 (.8)				Chapter 8: "Communication" (pp.239-241)
Public Administration Understanding Management, Politics, and Law in the Public Sector by Rosenbloom and Kravchuk (2002)	5 (.9)			Chapter 7: "Decision-making (pp.338, 372-373)	Chapter 13: "The Future" (pp. 595-596)
Public Administration: An Action Orientation by Denhardt (1999)	10 (3)	Chapter 5: "Budgeting & Financial Management" (pp.186-188)			Chapter 9: "Reinventing Government" (pp. 318, 322-326, 328-329)
Current Issues in Public Administration by Lane (1999)	17 (5)				Chapter 5: "Understanding Public Organizations" (pp. 182-198)
Public Administration and Public Affairs by Henry (2001)	16 (5)		Chapter 6: "The Systems Approach & Management Science" (pp.148-163)		

[a] Percentages (in parentheses) are calculated using number of textbook pages as bases (i.e., excluding appendixes, references, and indexes.)

top textbook. Finally, Lane and Berkeley and Rouse were picked based on an Internet search of public administration textbooks published since 1998.

Table 2 indicates the remarkable lack of attention that these textbooks give to computing. Henry (2001) and Lane's textbooks have the highest number of pages, 16 and 17, respectively, representing a whopping five percent of the book treating computing as a topic or at least a mention. Similar to the three general public administration journals studied earlier, computing is just not a textbook topic of major importance.

An additional concern, besides the amount of attention given to computing in these texts, is how it is treated. As Table 2 indicates, computing does not have its own chapter except in Henry's textbook. Computing as a topic also appears not to have any consistent rubric under which it is treated. Computing is mentioned in a finance chapter and in a decision-making chapter and appears in four eclectic chapters. Such inconsistent treatment suggests that computing has not been integrated into all areas of public administration and, in fact, has not even found a home in one area.

Need for a Book on Computing for Public Administrators

Without a doubt, computing has permeated the practice of public administration at all levels of government in the United States. NASPAA has recognized this by requiring all accredited MPA programs to include in their programs information management, including computer literacy and applications. Yet, in spite of the importance the work world and NASPAA has put on computing education, the two tables in this chapter show that textbooks and general public administration journals barely treat computing as a topic worthy of mention. Consequently, there is the strong sense that we all say computing is important, but it is more lip service than actual service. If it is truly accepted as important, computing should be a common research topic in our leading journals, a common topic in our textbooks, and thus a topic on which we are working hard to build a common body of knowledge. This is not true today, seventeen years since we as a profession formally recognized computing's importance. How can there be a common theme or treatment to computing education if the textbooks and respected journals offer minuscule help or encouragement? A major way to begin correcting this dismal state is the present publication of an edited book on information technology and computer applications. This author also refers the reader to the articles that mention computers, listed at the end of this chapter. Articles going back to 1985 from the three journals are listed there.

SKILLS: GENERIC APPLICATIONS

The Six Generic Applications

A person looking for a responsible job in city, county, state, or federal government will be expected to indicate computer skills on the resume. Experience with dedicated computer applications in one's area, such as human resources, will enhance one's employability. Of greater fundamental importance, there are computer skills that are commonly expected of all job applicants. These computer skills are generic because any job applicant would be wise to have them. The generic computer skills include word processing, spreadsheet, graphics or data presentation, database management, e-mail, and Internet. Using Geographic information systems (GIS) is a computer skill that is on the fast track to becoming a generic application, too. There are also benefits to knowing a simple desktop publishing application; however, while desktop publishing is a nice and even a fun skill, it is not on the level of the other generic skills for PA professionals. One can develop a niche for oneself in an organization if one can produce a newsletter, but the niche is not an administrative one.

Word Processing

Enough said.

Spreadsheets

Spreadsheets is a data analysis application that has a myriad of uses and probably is taught or utilized in several public administration graduate courses. Obviously, the accounting function of any department or governmental unit is made easier through spreadsheets. But other functions also find the list nature and built-in formula of spreadsheets useful. Human resource professionals can use spreadsheets to help in contract negotiations, and public works administrators can keep track of road-repaving schedules.

Graphics

The ability to do graphics is a very important all-purpose tool. Pictures drive home a point better than words. Studies show that people remember what they have seen better than what they have heard. Graphics, therefore, can make a presentation clearer and more powerful. Graphics can also make a report clearer and more powerful. It is not uncommon for people to quickly skim a report right before a meeting or even look at it for the first time during the meeting. The net result is the subtleties of language are often overlooked or misunderstood. Graphical displays of main points are more likely to be looked at and become the foci of discussion or evaluation. Always keep in mind the audience for the report or presentation. What does the audience bring to the table and under what conditions? Will the audience have had time to carefully read the report? What do they want to learn from the report, are they familiar with the terms used, and what are the controversial or contentious aspects of the report? Plan graphical displays based on the answers to the above questions.

Database Management

Database management applications allow one to keep track of almost anything one can imagine. Inventory and mailing lists are excellent uses for such applications. One can link the data to spreadsheets and drop tables into a word-processing report. If one has too much related information to keep track of in one table, one can create relationships that tie two or more tables together. The query option is a powerful information search feature. For example, one can query for the names of the female senior citizens that called 911 in the last three months or the names of teenagers who have volunteered in a department in the last year.

E-mail

E-mail is helping offices cut down on paperwork and speed communication while saving money in terms of mail, phone costs, and time. Of course, e-mail also has a down side. One's e-mailbox can also get filled with useless lists of jokes, reports that do not need to be widely shared, and personal mail. As no office can exist today without word-processing, the same can be said about e-mail. If one is to communicate, one needs to know how to send, respond to, copy others, customize address book, flag mail, etc.

One major point about the use of e-mail needs to be stressed. Communication that used to be done by phone or in person now is often done by e-mail. E-mail encourages people to talk more frankly, quickly (both in terms of number of words used and speed of reply), and equally often without respectfulness to recipient who is a superior. There are also no cues from word inflections or facial expressions in e-mail. Keep this point in mind when one sends e-mail to people one does not communicate often with in person or by phone. Major misunderstandings can result from e-mail communication, and such misunderstandings take longer to catch or clear up. Beware of overuse of the word "you" as well as strong words such as "that's a stupid idea."

Internet

The World Wide Web is exploding daily with sites that are used by or are maintained by government units, who started it in the first place. Cities and states in the US use home pages to attract both businesses and visitors and to learn about their citizens through surveys. Home pages are used to provide services, too. For example, cities and counties post job openings, building applications, bid requests, and low-income housing applications. Information for the local citizenry from weather reports to lists of important dates and phone numbers to restaurant locations are just some of the things that can be found on home pages. Governmental units also use the World Wide Web to do research. For instance, when a city is considering a new ordinance, it can check out how other cities have dealt with the topic. Cities are also utilizing the Internet to spread the word about dangerous fugitives. A sound familiarity with the Internet is essential for anyone seeking to work in or learn about public administration. One should not only know how to surf the Internet, but also one should check out city, county, state, and federal sites. The magazine *Government Technology* gives yearly awards to the best government sites. In addition, *MuniNet Guide & Review* gives models for "online excellence."

GIS

Geographic information systems initially were used in planning and public works departments. But the mapping uses have exploded as other departments have recognized the usefulness of GIS capabilities. Land can be mapped to show electrical and water lines, elevation, ownership, vegetation, parcel value, watercourses, erosion, soil type, wildlife habitat, pesticide and fertilizer application, rat population, and type of crime, and such data can be connected and overlaid for multiple uses. In fact, cities have found that they can sell their GIS-generated maps. The new hand-held GIS systems with microphones open up even more possibilities. For example, the hand-held voice-activated systems allow inspectors driving down streets to automatically order work to be done or to cite code violators by just saying, "stop sign down" or "pothole." Another benefit of GIS is the maps can really enhance public presentations.

DEDICATED APPLICATIONS

On-the-job or classroom experience in dedicated computer applications is also very helpful. However, unlike the generic applications, knowledge of specialized applications is not as versatile to all settings. There are many dedicated applications for hundreds of tasks such as case management, manpower, disaster recovery, and mapping. The point is that knowing one of these applications may not be portable to the same job but in a different organization. Applications are often tailored for an organization or custom-made. Moreover, applications have different impacts from one setting to another. Consider the varied uses for teleconferencing. Teleconferencing can be used for parole hearings or staff training or agency meetings. Each of these uses has different impacts, and their effectiveness varies by the setting.

What is clearly useful is some familiarity with the types of applications used in the field in which one is planning to build one's career. By *familiarity* is meant awareness of basic features and strengths and weaknesses of applications for the line personnel, managers, and citizens. Database management issues should also be considered.

In a classroom setting different students can present an overview of different specialized applications. This can be accomplished through overheads, handouts, or actual computer demonstrations. The overview could be based on the students' experiences but definitely should include insights gained from interviewing several people who use the application on the job. The people chosen to be interviewed should have various years of experience with the application in the organization. Perspectives vary when one can include a before-and-after time frame as well as variability in job responsibilities. Presentations and related papers should touch on the strengths and weaknesses of the applications to do the work function and the ease of learning how to use the application (Northrop, 2002).

MANAGEMENT ISSUES

A master's in Public Administration signifies the recipient has the skills to manage people and tasks in an environment of both internal and external political demands and responsibilities. What are some key issues about which an MPA graduate should be conversant when it comes to managing in a computerized environment? First and foremost is the fact that computerization of a task does not necessarily lead to payoffs and more than likely will underachieve expectations. It is important to understand what factors affect payoffs and then address how to deal with them. The following section briefly points out factors that have been shown to influence the usefulness of computer applications.

Quality of Data

An absolute condition for achieving payoffs from computerization is that the data must be accurate. A system to control input errors and to change data must be instituted. In contrast, the length of time to get information from a computerized task does not need to be made as short as possible. Data that can be quickly retrieved is very nice, but data that many users think takes too long to be retrieved will still be used if it is considered useful.

Training

Managers must devote more resources and ongoing thought to training. Based on an informal survey of more than 450 public employees, this was one of the top two lessons that were a constant theme from department to department and application to application and employee to employee (Northrop, 2002).

One obviously needs a training program to teach users how to use new applications. Another related consideration is having a way to train new hires in ongoing applications. In addition, an initial training program should not be considered the end of training. Follow-up training programs or help sessions need to be routinized; training should be considered an ongoing process.

Then there is the issue of who should do the training. There is no clear answer whether in-house trainers or external trainers are best or whether professional trainers or just experienced employees are best (Northrop et al., 1994). Professional trainers bring experience in conveying application knowledge, but sometimes an employee who uses the program is better at answering questions about how to use the program within the context of the work product.

Personnel

Employees bring skills to an organization and also gain skills on the job. The effectiveness and efficiency benefits of computerized applications are affected by the skills of the employees who use them. Some employees come with knowledge and experience with the computerized application; some do not. Some employees are more resistant than others to using and exploring a new or updated application. And, as is well known, employees vary in their work ethic, concentration, and diligence.

Hardware Compatibility

The computer field is known for its almost constant change. Upgrading or expanding a computer system is an expensive and disruptive proposition.

There can be costs if one only upgrades the computers of some employees. Reports may no longer be able to be downloaded or sent to normal recipients if the upgrade results in computers which are not compatible needing to talk to each other.

Resources

Computerized applications may be able to provide all sorts of new and valuable information to decision makers. But the information is only useful if the organization has the resources to take full advantage of the new information. To illustrate, a computerized manpower application system can outline where and how many police officers one needs to deploy at a certain time of day across the city. If the police department has that many officers available, all is well and good. If not, whether due to limits on force size or just scheduling variations, the computerized manpower information will not help much in the fight against crime.

What One Automates

When one is automating a task or upgrading a task system, the success of the present system to do the work needs to be considered. Often an organization just automates the way it presently does a task. If, for example, the present way one tracks the names of people who should be paying child support only finds and receives payment from twenty percent of the list, then the automated system will likely not do better. Therefore, an evaluation of the extent to which policy goals are currently being met should be required before a task is automated or upgraded.

Who to Involve in Adoption Decisions

Oddly enough, some organizations never consult the very employees who will use the new computer application to see what they need and to get their input on the weaknesses of the old application. Employees from all levels who will use the application should be asked for their input, from line personnel to managers.

Purchasing a Customized System

Experience at the federal, state, and local level point out that purchasing an information system is rife with risks. Millions have been spent on systems that were delivered years after being promised or that never worked. Choosing a company and writing a contract should be done with much care. Consider purchasing a customized system as similar to choosing and working with a contractor to remodel one's house. Payments should not be made until each stage is approved. A final payment should be held back till the developer fixes the little problems in the system. Expect to pay more if the organization changes its specifications of the system, but build into the contract a cost. A bonus can be offered if the system is finished before the agreed-upon date, and penalties can be assessed if the system is delivered after the expected date. And above all ask for references and check them. Send a representative to other organizations that have contracted with the system development company. Do not just call. Remember line staff may have a different perspective than a manager; all input is relevant.

Management Support

This is the second-most frequent lesson passed on by more than 450 public employees (Northrop, 2002). Management must be supportive of the computer application. Staff personnel have been known to just not use the application because management has given the signal indirectly that they do not see the usefulness of the application. One way that management can effectively show support is to actively use the application or the generated reports. If the staff have a question about the application, management should be able to answer the question even if this only means referring the staff to someone else who can help. Management must show they care about staff knowing and effectively using the application. It is up to management to sell the usefulness of the application to employees.

Security

Security has been considered a major management concern since the early computerization of data. If data are accessible and changeable by inappropriate personnel, major legal issues involving rights compromise the usefulness of the computerized database. Depending on the department or agency, security issues vary. For example, police field reports once entered should not be able to be changed at will by any patrol officer. Incident reports must be protected from being expunged or altered to protect the integrity of the court case from bribes or favoritism. Personnel files need to be more widely accessible to change to update job title, benefits, and addresses. But extent of access to personnel information must also be limited. The security needed for some national computer databases, such as Social Security, is monumental.

CONCLUSION

A PA graduate needs hands-on skills in computer applications, both mastery of generic applications and familiarity with dedicated applications. Said graduate also needs to be conversant with the issues involved in successfully managing information technology and computer applications.

Professional journals do offer useful articles on information technology, even if few in number. But general PA textbooks are not a source for building one's knowledge in this important area. Thus, edited books, like the present one, are critical for universities to provide a common grounding in computer education for their PA graduates.

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Chapter II

Politics, Accountability, and Governmental Information Systems

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ABSTRACT

Information systems are becoming more involved in politics due to the growth of the World Wide Web, electronic government, and the increasing digitization of information of all kinds. Many information management specialists lack knowledge and experience about how to deal with political aspects of information management, and consequently they are ineffective. This chapter shows how important political issues are to information managers and illustrates strategies that can be useful in dealing with political issues. I provide several examples of how inattention to the political aspects of managing information systems can result in problems and disasters. The chapter covers both internal and external politics. Information managers have to deal with many internal politically-charged tasks such as the structuring of information management, purchasing information systems, managing personnel in this era of digital communication, and struggles over the sharing of information within organizations. External information management issues are also becoming important such as demands for online accountability information, the development of websites, issues over access to information, and interorganizational issues including disputes over turf.

INTRODUCTION

The underlying premise of this chapter is that information is power, and consequently information management is inherently political. Information asymmetries give an advantage of one actor over others (Bellamy, 2000). Maintaining control over information can allow individuals, departments, or organizations to control how successful they appear to others and thus may protect autonomy, job security, and funding. Although information management involves many technical issues, it is important to understand that it involves major political challenges. A large portion of governmental information managers come from technical backgrounds such as computer science and business. They usually have excellent technical skills and they can quickly rise to leadership positions such as Chief Information Office (CIO). However, decision-making concerning the management of information technology (IT) requires more than technical knowledge. The most important critical success factors involve organizational and political skills that the technologically skilled often lack, but these skills can be learned. This chapter identifies some of the key political problems that are likely to be faced. Some technical staff dislike and try to avoid dealing with political dilemmas. Molta (1999, p. 23) says "engineers and programmers frequently appear oblivious to the strategic issues that keep management awake at night." He goes on to state that managing information technology is "the most politicized issue of the modern organization" and that technical staff "need to get in the game." Refraining from politics will lead to more serious problems and result in ineffective management of information technology.

Before the days of the World Wide Web and electronic government, managers and user departments often deferred computing decisions to technical staff because information management was not central to organization (Lucas, 1984) and generalist managers had little knowledge to contest decisions made by technicians. As information has become a central concern, user departments themselves often have their own technical staff, and generalist managers often become "technical junkies" (Molta, 1999, p. 24) and keep abreast of technological trends. Consequently, technical skills themselves are not sufficient to be effective for information managers to achieve their goals. A study (Overton, Frolick, & Wilkes, 1996) of the implementation of executive information systems (EISs) found that political concerns were perceived as the biggest obstacles to success. Many people felt threatened by the installation of such systems for a variety of reasons, including fears of loss of job and increased "executive scrutiny" (Overton, Frolick, & Wilkes, p. 50). Feldman (2002) also sees politics as one of the biggest challenges for technical managers. Feldman (2002) observed that technicians often adopt a "bunker mentality" on important technology decisions and fail to take effective steps to achieve their goals. Peled (2000) also argues that information technology leaders need to bolster their "politicking" skills to boost the rate of their success. Noll and Wilkins (2002) did a survey of 67 employers who recruit IS professionals and asked them to rate the importance of skills they considered to be most important. They (Noll & Wilkins, 2002, p. 151-152) found that employers ranked "soft skills" such as knowledge of the specific business, ability to plan, organize, and to work collaboratively more highly than technical skills. A survey (Anonymous, 1994) of over 500 British managers revealed that the majority believe that information flows were constrained by politics and that individuals use information politics for their "own advancement." In short, the effective use of political skills is an important component of effective information management.

Over the past decade, computing has become much more important in governmental as well as private organizations. Major decisions about computing have always involved politics. Detailed studies of cities in the 1970s (Laudon, 1974) and 1980s (Danziger et al., 1982) discuss several cases involving computing and politics. But computing was less central to public organizations then. Most employees had minimal contact with computing but now routinely employ computer technology in many of their day-to-day practices. They use e-mail, the Internet, and a variety of computer modules to accomplish their tasks. Computing is a central part of their jobs, and they care about technology. The development of e-government and the Internet has greatly broadened the end users of governmental information systems so that now they include citizens and groups, such as contractors. Information technology now is employed to provide greater forms of accountability to the public such as using computers to derive sophisticated assessments of performance and posting performance measures on the Internet. As a result, information technology decisions are more complex and subject to the influence of external politics.

I analytically differentiate the politics of information management into two major different categories: (1) internal, organizational politics concerning issues involving organizational members; and (2) external politics concerning how the governmental organization relates to its councils or boards, other organizations, external groups, and general citizenry. However, these two forms of politics frequently overlap and influence each other. I have avoided giving many prescriptions to managers on how to behave politically not only because research about politics is sketchy but also because politics is highly contextual.

The course of action that should be pursued depends on the complex interplay of political resources of the actors involved, ethical concerns, legal issues, as well as economic and technical factors. My purpose is to sensitize information managers and generalist administrators to major political issues that are likely to affect IT decisions. I outline examples of both successful and unsuccessful strategies that managers have employed to deal with information politics.

A NOTE ON SOURCES AND METHODS

This study makes use of my own experiences as well as draws upon literature concerning public information management. I found very little formal research in recent years that explicitly focuses on the politics of information management. Indeed, most of the major and rigorous academic studies that have focused on the politics of computing date back to the mainframe era (e.g., Danziger, 1977; Dutton & Kraemer, 1985). In some more recent studies of computing, political aspects are touched on and I draw on examples drawn from the literature to illustrate my points. Due to its lack of coverage in traditional academic journals, I make use of periodicals such as computer magazines and newspaper articles concerning computing. Also, many of my examples are based on my own 20 years of experience and study of public organizations at the municipal, state, and federal levels to illustrate my points.

INFORMATION SYSTEMS AND INTERNAL, ORGANIZATIONAL POLITICS

Although almost any decision about computing can become embroiled in politics, my experience is that the most prominent and important political issues involve questions of control and power over the following kinds of decisions:

- Information Management Structures: How should information management be structured? Where should control over information be placed in the organizational structure?
- Hardware and Software Acquisitions: What should be the nature of the process? How centralized should it be? Who should be involved? Should outsourcing be used?
- Information Management, Sharing Information, and Interdepartmental Relations: What process should be used to determine information sharing and exchange? How will computing influence and be influenced by other

aspects of interdepartmental relations? How can obstacles to sharing information be overcome?

- Managing Personnel and Communication Flows: How does computing influence employee relations and communication flows? What, if any, rules and procedures should be established? How do e-mail and other forms of computer-mediated communication (CMC) influence communication and organizational politics? How does information technology influence the careers of organizational members?

Although each of these decision areas has technical aspects, nontechnical issues such as concerns about autonomy and power often prevail. Below, I outline how each of these decision areas involves important political aspects. Many information managers prefer to avoid these political aspects. Likewise, generalist managers such as city managers have often ignored direct involvement in these decisions due to their lack of expertise concerning computers. As a consequence, it has been my experience that persons other than information system or generalist managers often dominate these decisions. Consequently, these issues are often decided without adequate attention from those with the most expertise or broadest perspective.

Information Management Structures

In the days of the mainframe, there was often little interest on the part of most employees as to how computing was structured. Due to the fact that computing was used to perform routine tasks such as water bills and routine accounting reports, the computing function was placed originally under the control of the budget/finance department in many municipalities. Computing was often done on a mainframe machine, and data processing departments controlled the development of applications. End users tended to have little involvement in computing decisions. As the importance of computing has grown and spread along with decentralization due to microcomputers and distributed computing, the original structures have become outmoded. Now that virtually all employees actively employ computer technology, end-user departments care about how computing is organized.

But there is no consensus as to the best method of organizing computing. How centralized or decentralized should computing be? There are advantages and disadvantages to the centralization of computing, and one major review of the centralization-decentralization debate (King, 1983) concluded that "political factors" are paramount in decisions on how to structure computing. Business organizations have encountered the same dilemma. Markus (1983) has described how business departments have resisted efforts at integration of information systems. Davenport et al. (1992) found several reasons behind information politics including: (1) units that share information fully may lose their reason for existence; and (2) weak divisions may be reluctant to share information when they are sensitive about their performance.

Where should computing be placed in the organizational structure of a public organization such as a city? Should it be a separate line department, a subunit of another department (e.g., budgeting/finance), or a staff unit to the manager/mayor? Should mayors/managers require that the head of computing report directly to themselves or should they place a staff member in charge? There is no universal answer to these questions. Small organizations may still rely primarily on generalist managers supplemented by assistance from consultants and contractors. For larger organizations, the centrality of today's computing to all departments would suggest that information management should be in a separate unit and not be structurally placed under another department such as budget/finance. There has been a strong movement at the federal and state levels to establish a CIO to deal with problems of technological issues that cut "cross departmental" boundaries and to head efforts at building corporate-wide e-government and intranet systems (Fabris, 1998). But managers, both computing and generalist, need to think carefully about the implications of these different arrangements and which structure is most likely to meet the needs of the organization. In the past, many local government executives have complained about the feeling that the information they need to run a city exists somewhere but that they can't seem to access it effectively (Danziger, 1977). Ackoff (1967) argued that managers who took a hands-off approach to computing would suffer from "management misinformation systems." Decisions concerning the structure will be based on a number of factors, including the degree of interest of the generalist managers in computing as well as what goals managers have for IT.

Molta (1999, p. 23) defines politics as the "allocation of resources within an organization." Some departments will want to control their own computing as much as possible through the hiring of their own information technology (IT) staff. Eiring (1999, p. 17) defines politics as the "art of negotiation, compromise, and satisfaction" and urges information management staff to form strategic alliances that are beneficial to the IT cause and "nurture them as one would a good lasting friendship" (Eiring, 1999, p. 19). Feldman (2002, p. 46) warns that "when departments are doing their own thing—namely hiring their own IT staff—a central IT department is in political trouble." He goes on to point out that hiring their own staff implies unhappiness with the services of the central IT unit. However, in many organizations, it has been common and perhaps necessary for line departments to have staff dedicated to IT. For example, police departments often have their own dedicated systems and staff because of the early development of police information systems, the centrality of computer searches to their function, and the need to have secure and easy exchange with other police departments. When non-IT department information technology staff exist, one political issue is how they should relate to the central IT staff. Feldman (2002, p. 48) argues that the smart strategy is for the central IT staff to offer "to exchange information and support" with non-IT department staff. By taking these steps, Feldman (2002) argues that they can at least establish "dotted line relationships." Feldman argues further that these non-IT technological staff are often isolated and appreciate the support from the central IT department. The only alternative is to try to control all computing from the central IT department, but this strategy can either work very well or turn out to be a disaster (Feldman, 2002, p. 48).

A major rationale for the existence of a CIO (as opposed to a traditional data processing manager) is that (s)he will not be restricted to technical issues but act as a change agent, politician, proactivist, and integrator as well (Pitkin, 1993). The federal government (Koskinen, 1996; Pastore, 1995) has firmly established the use of CIOs in order to improve information management. Will it have a positive impact? Should the CIO model be followed in municipalities and other public organizations? Merely assigning the CIO title does not ensure that these functions will be performed. For example, a study (Pitkin, 1993) of CIOs in universities found that, despite their title, they did not view themselves as executives and often do not perform these non-technical roles. Without a push from a CIO, public organizations may fail to make good use of information technology. For example, one study found that police regularly used their database systems for reports to external agencies but rarely for internal management purposes (Rocheleau, 1993). CIOs and centralized information structures help to fix responsibility, and that can mean that they themselves become targets of unhappiness with technological decisions. There are many cases in which CIOs in the private sector have not been viewed favorably by their fellow managers (Freedman, 1994) and that CIOs in both public and private sector are blamed for failures (Newcombe, 1995; Cone, 1996).

In my experience, there is a wide variety in the amount of attention devoted by managers to structural issues concerning computing. In one city, a city manager was very much focused on information management and devoted great attention to decisions made concerning computing by the city, in effect acting as the municipality's CIO. His focus on information technology enabled him to establish a positive reputation for innovation that helped to secure his next job. When this manager left for another city, he was replaced by another manager who was not especially interested in computing. Devoting great attention to computing can be both productive and counterproductive. The first manager who was heavily involved in computing issues became embroiled in severe struggles with his new board and organization over IT that contributed to his resignation from his new job.

Although there is no single right way of organizing computing, each manager needs to ensure that the structure will provide relevant, timely and reliable information. Kraemer and King (1976, 25) argue that public executives spend too much of their time on decisions concerning the purchase of equipment and too little on other important information management issues that have less visibility but are equally important. Kraemer and King (1976) emphasize the need for generalist managers to take personal responsibility for computing and to be engaged in the following decisions: how to structure computing, the purposes to be served by computing, and implementation issues such as the goals of computing and the structures used to achieve them.

Some experts (e.g., Severin, 1993) argue that the Chief Executive Officer (CEO) of an organization should be the CIO. Mayor Stephen Goldsmith of Indianapolis is an example of a CEO who took charge of the information technology function and instituted a number of important policy changes such as privatizing many IT functions as well as encouraging e-mail from any employees directly to himself (Poulos, 1998). John Kost (1996) was appointed to be CIO of the State of Michigan by Governor Engler and instituted several policy goals of Engler's such as consolidation of state data centers, establishment of statewide standards, and reengineering of IT, including its procurement process. It is notable that Kost did not have any IT background at all (Kost, 1996). Kost maintains that it is more important that the CIO understand the business of government than have a strong technology background (Kost, 1996, 30). Kost proceeded to do a major reengineering of IT in Michigan and claims that they successfully achieved many of the goals set by Engler.

Paul Strassmann served as director of defense information at the Defense Department from 1991 to 1993 where he was in charge of a $10 billion annual budget for IT and instituted major changes in the procurement process. Strassmann subsequently published a book titled *The Politics of Information Management* (Strassmann, 1995, xxv), in which he argues that managing IT is "primarily a matter of politics and only secondarily a matter of technology." Strassmann goes on to hold that only the technical aspects of information can be safely delegated to computer specialists. Strassmann (1995, xxix) supports a federalist approach to information management, "delegating maximum authority to those who actually need to use the information." Strassmann (1994, 10) believes that it is the duty of the CEO to establish general principles: "Without a general consensus about the principles and policies of who does what, when, and how, you cannot create a foundation on which to construct information superiority." Strassman says that the CEO should never delegate the responsibility for information management to a CIO, because it is the CEO who must decide how to apply information systems.

Peled (2000) presents two case studies involving information technology leaders in Israel. In one case, a prestigious scientist with outstanding technical skills was called in to solve transportation problems by employing computing technology. This technologist viewed his job in technical terms and attempted to develop a project without communicating and building support for it with other key actors (Peled, 2000, p. 26). He refused to share information with other departments working on related projects and consequently encountered resistance leading to his resignation and the end of the project (Peled, 2000, p. 27). His failure was largely due to deficiencies in communication and lack of knowledge of organizational politics, such as the need to obtain support from others in order to develop a project. Peled (2000) provides a second case study in which a leader without any major technical skills was able to solve serious problems of building a land-registry database. He used a training system to develop a core of users and people committed to the new database and negotiated with unions about wage demands for using the new system. This leader viewed his project in political terms from the very beginning, and this approach helped him to achieve success.

The Purchasing Process

An underlying assumption of the current information resources management theory is that an organization's information system should be aligned with its business goals. A related assumption is that generalist managers must be involved in procurement and other important decisions. They need to specify what goals and functions should be achieved by the purchasing of new software and hardware. Sandlin (1996, p. 11) argues that managers need to be on guard for "technological infatuation." Sandlin (1996) points out that generalist managers would never let the transportation departments buy a line of expensive cars, but they often allow the equivalent purchases in the IT area. Managers sometimes purchase expensive systems (e.g., corporate-wide geographic information systems) because everyone else is getting them without thinking enough about whether the benefits from applications will justify the enormous costs involved.

The failure of expensive new computer systems is likely to expose governmental managers to political attacks. Even if knowledge of the failure remains internal, unsuccessful systems can undermine central management, IT, and other departments involved. The problem often begins with the failure of internal management of the projects. For example, the Federal Retirement Thrift Investment Board fired and sued its contractor, American Management Systems (AMS) of Fairfax, Virginia (Friel, 2001) for breach of contract. The contractor defended itself by stating that the board had not determined system needs even three years after the beginning of the contract (Friel, 2000). The determination of system needs is primarily a managerial issue. The pervasiveness of contract failures has led to what some refer to as a "contract crisis" (Dizard, 2001) with political consequences:

> *Thanks to new project management techniques, improved oversight, employee training, and contract controls, several state CIOs reported that project failures are decreasing. But they agreed that the* political cost of bungled projects remains high *[emphasis added].*

The US General Accounting Office (2002) studied the Department of Defense (DOD) Standard Purchasing System and found that 60 percent of the user population surveyed were dissatisfied with its functionality and performance. If a failed project has high visibility, then often external political issues also develop; but even if not visible to outsiders, failed purchases weaken the credibility of IT staff, and thus purchasing process is one of the most critical areas for managers and IT staff to negotiate.

When direct use of computing was restricted to computer programmers, there was little interest in other departments concerning decisions about hardware and software. But as end-user computing has grown, end users have enjoyed the freedom to innovate, and strong centrifugal forces have resulted. Employees often have strong personal preferences and feelings concerning software and hardware purchases. Part of the ethos of end-user computing is the ability to make your own decisions about software and hardware. Allowing each end user (or end-user department) to make decisions about software is likely to lead to multiple hardware and software platforms. In some cases, the case for a separate standard is based on strong technical reasons. For example, Unix workstations have often been used by engineering departments in cities, while the rest of the city is likely to use PCs. Until recently, only these Unix workstations had the power and software to perform the graphics required for the engineering jobs. Consequently, engineers often used Unix-based machines while the rest of the municipality usually employed microcomputers, and this multiplicity of platforms was justified by technical considerations.

There are other tradeoffs between allowing each department to use its preferred software and hardware versus centralization. Multiple platforms complicate training, backup, and maintenance too. The existence of "platform zealots" is not unusual and can lead to conflict (Hayes, 1996). In my experience, these problems with multiple platforms have led certain managers toward establishing a single platform and also centralized control over hardware and software acquisitions. In some cases, this author has seen an interdepartmental committee established to make purchasing decisions that exceed some threshold of expenditure. In other cases, the review process is done alone by the person heading the information management function. Barrett and Greene (2001) make the point that leaders need to convince the end users of the strong advantages and rationale for standardization of hardware and software. If they fail to take this step, they are likely to encounter, directly or indirectly, passive resistance to their policies. In some cases, formal control of IT purchases by the IT department is impossible if the funding source for hardware and software is from another level of government (e.g., state or federal funding). Regardless of what approach is taken, information management and generalist administrators need to provide the centripetal force needed to integrate information management in public organizations. If they don't do it, no one else will. But this integrating role often runs into stiff resistance, and it requires that the manager use powers of persuasion, negotiation, bargaining, and sometimes authority and threats.

Many generalist managers may want to establish general policies that influence purchasing choices of departments such as the following: (1) some governments take a position that data processing functions should be privatized as much as possible; (2) many governments have instituted online purchasing and forms of purchasing pools which departments may be required to adhere to; and (3) some governments are establishing special arrangements with a small number of computer vendors with the idea of achieving advantageous pricing arrangements. Both the federal and many state governments have been revamping the purchasing process with more emphasis on speeding the process and emphasizing value rather than lowest cost (Rocheleau, 2000). Kost (1996, p. 8) believes that the CIO and CEO need to take charge of the purchasing process if they are to achieve goals such as privatization and "value purchasing":

> *For example, a policy advocating privatization is doomed unless the purchasing process allows privatization to occur…. An intransigent purchasing director can often do more to thwart the direction of the administration than a policy maker from the opposite political party.*

At the federal level, Strassmann implemented a corporate information management (CIM) initiative that was aimed at streamlining the military's information system purchases such as the use of the same systems across the different services. Strassmann enunciated the following principle which the technicians were expected to follow: enhance existing information systems rather than "opt for new systems development as the preferred choice" (Strassmann, 1995, p. 94). In one case, this CIM approach killed an $800 million Air Force system and replaced it with a similar one that was used by the Army (Caldwell, 1992). The Air Force had already spent 28 million dollars on their system and resisted the move. Observers of the process noted that it was a "turf issue," and a GAO report concluded that CIM required centralization and a "cultural change" that were difficult for the Defense Department (Caldwell, 1992, pp. 12-13).

The acquisition and implementation of new systems often engender resistance. One of the basic principles of planning for new computer systems is to involve the people who will be using the system in its design, testing, and implementation phases. Indeed, there are entire books written concerning the principles of participatory design (Kello, 1996). An apparent example of user resistance occurred recently in Chicago when a new computer system was introduced to speed the building permits process. After the system was implemented, lengthy delays have drawn widespread criticism (Washburn, 1998), and the delays caused a bottleneck during a time of booming construction. The new system tracks permit applications, allows scanning in of plumbing, electrical and other plans so that the plans can be viewed simultaneously on several screens. There have been some technical problems acknowledged by city officials. For example, some staff had trouble seeing plan details on their screens, and on-the-spot corrections were not possible due to the fact that applicants were not present when reviews were done. But officials argue that many of the complaints are due to the fact that the system has changed the process of handling permits. Permits are now done on a first-in-first-out basis, while before expediters used to "butt into line" and now fear their loss of influence under the new system (Washburn, 1998). They contend that the expediters are deliberately spreading false rumors about extensive delays in an attempt to "torpedo the new system."

The desire to standardize can create problems for managers. For example, vendors who target their products to municipal governments begin with a basic general ledger and finance product and then expand to develop modules for other functions such as the permit and other processes. Managers see advantages to using the same vendor for all of their different modules, such as ensuring interoperability among them as well as gaining favorable financial terms. However, in this author's experience, vendors who have strong financial modules often are weak in other areas, and thus the desire to standardize on one vendor's software can lead to problems with end users who do not like these other modules of the vendor. In such cases, it is clear that generalist and information system managers will have to be sensitive to organizational politics and either accept the need for diversity in vendors or employ their personal and political resources to achieve change.

Computing, Sharing Information, and the Politics of Interdepartmental Relations

In addition to purchasing issues, there are many other interdepartmental issues that need to be dealt with by CIOs and generalist managers in order to establish an effective information system. For example, computing creates the possibility of free and easy exchange of information among governmental organizations. But information is power, and organizations tend to be sensitive about giving out information to outsiders, especially if it reflects on the quality of the organization's operations. Many agencies prefer to maintain autonomy over their data. For example, the author worked on a project with the job-training agency of a state agency in a project that was to employ databases drawn from several state agencies to evaluate the state's job training programs. However, despite obtaining verbal agreements from the top managers of the agency, the lower-level programming staff delayed the sharing of data for months. It became clear that they saw our requests as an additional burden on them that would make their job more difficult if such requests were to become routinized.

Building e-commerce systems usually requires the cooperation and sharing of information among a number of different departments. Corbitt (2000, p. 128) conducted a case study of an organization that developed an e-commerce system and found that there were "important political and interest differences" among the departments as well as "differences in perceptions" that caused problems. In particular, Corbitt (2000, p. 125) found competition between the data division and the e-commerce group about what needed to be done and who should exert leadership over it. Corbitt (2000, p. 128) concludes that power is a "very substantial issue affecting implementation success."

Some new technologies such as geographic information systems (GIS) are forcing changes in computing structures and procedures among departments. Although many geographic information systems are initiated by a single department, the systems are expensive, and the software is relevant to many different departments. When Kansas City decided to build a GIS (Murphy, 1995), they found it necessary to form a GIS committee (made up of representatives of four participating departments: Public Works, Water, City Development, and Finance) to conduct an interdepartmental needs assessment and resolve problems such as how to resolve conflicts in databases and how to minimize database development costs. Although such developments do force structural changes, there is still wide latitude in regard to the nature of the structure. Sharing data can lead to conflict. In a study of exchange of information between municipal department such as fire and police, Rocheleau (1995) found that a large percentage fail to exchange information despite overlaps in their job responsibilities concerning problems like arson and emergencies. The author studied one city where the fire department, clerk's office, and building department all shared information responsibility for entering information about buildings, but each department tended to point their finger at others when mistakes in the data were discovered. A major task of generalist and information managers is to deal with departmental concern with autonomy over the databases. If they defer to the status quo, information management will be less effective. Bringing about change required to achieve integration may aggravate such conflicts. Overcoming these obstacles requires negotiating and political and organizational skills.

Top managers may force the exchange of information via command. However, employees often find ways to resist change. For example, they may provide poor quality information that renders the exchange useless. Markus and Keil (1994) provide a case study of a new-and-improved decision support system designed to help sales persons that failed because it worked counter to underlying organizational incentives. The system was aimed at producing more accurate price quotes, but it hampered the sales staff's ability to sell systems, their most important goal.

The relationship between technology and individual career ambitions can lead to political aspects of information management. Knights and Murray (1994) have conducted one of the few detailed studies of the politics of information technology. In their case study of IT in an insurance company, they concluded that the success and failure of the system was closely tied to the careers of managers. Consequently, these managers often attempted to control the perception of the success of these systems because perception is reality (Knights & Murray, 1994, p. 172):

> *The secret of success lies in the fact that if enough people believe something is a success then it really is a success . . . it was vital for the company and for managerial careers that the pensions project was a success.*

One of the key points made by Knights and Murray is that computing decisions become inextricably entangled with career ambitions and fears of individual employees and become embroiled in a very personal form of politics. Another detailed case study (Brown, 1998) of the implementation of a new computer system in a hospital found that different groups (the hematology ward, hematology laboratory, and information technology team) had very different perspectives on the reason for the failure of a new computer system. Moreover, each of the three groups used the common goal of patient care to legitimize its view of the system. Brown (1998) concludes that the study shows that participants were influenced by "attributional egotism" in which each person and group involved attributes favorable results to their own efforts and unfavorable results to external factors. Similar to Knights and Murray (1994), Brown concludes that many of the actions are taken to protect individual autonomy and discretion.

Grover, Lederer, and Sabherwal (1988) borrowed from the work of Bardach (1977) and Keen (1981) to outline 12 different "games" that are played by those involved in the IR process. They tested their framework by in-depth interviews with 18 IT professionals who confirmed that these games were played in their organizations. Most of their games involve interorganizational or interpersonal struggles similar to those I discussed above. For example, they discuss how in the "up for grabs" game, control over a new IT system involves struggles between the IT and other departments. They illustrate what they call the "reputational" game with a story about an IT manager who projected "a rough exterior" (Grover, Lederer, & Sabherwal, 1988, p. 153) to reduce demands on the IT department, but this approach led to a coalition against him and the IT department and resulted in the eventual demise of the IT manager.

The lesson of the above cases is that, prior to implementing new systems, information managers need to assess the organizational context and determine how proposed systems will be affected by incentives, informal norms, resistance to change and sharing, as well as other forms of organizational politics. Many of these factors may be addressed by including end users in the planning process. Managers will often have to be involved in exerting political influence and engage systems outside their direct control in order to assure a successful outcome. For example, Kost (1996) describes how the Michigan Department of Transportation decided to change from a mainframe to a client-server environment that endangered the jobs of a dozen mainframe technicians. The logical step was to retrain the mainframe technicians to do the new tasks, but the civil service rules and regulations required that the mainframe workers be laid off and new employees be recruited to fill the client server positions (Kost, 1996). Thus, in order to have an effective information system, generalist and information managers will often have to seek to change rules, procedures and structures. These changes may bring information managers into conflict with other departments.

Computing and Communication Patterns

Information technology such as e-mail can affect organizational communication patterns. Changes in communication flows can be extremely political. For example, if a subordinate communicates sensitive information to others without clearing it with her/his immediate supervisor, strife is likely to result. While he was mayor of Indianapolis, Stephen Goldsmith encouraged police officers and other public employees to contact him directly via e-mail (Miller, 1995a). He claims to have read 400 e-mail messages a day. Should mayors/managers encourage such use of direct contacts from employees? Although such communication can and does occur via phone and face-to-face communication, e-mail communications are different from face-to-face communications—there is less rich information, and many people act differently in e-mail than they do in person.

E-mail has become the dominant form of communication in many organizations, and it has implications for organizational politics (Markus, 1994; Rocheleau, 2002b). Markus (1994) has shown that e-mail is routinely used as a device to protect employees in games in which they feel it is necessary to "cover your anatomy." E-mail now provides a digitized trail that can be used to support employees concerning their reasons for doing that they did. Employees often copy e-mail messages to their own or other superiors to let them know what they think is necessary, thus attempting to bring more pressure on the recipient of the e-mail (Phillips & Eisenberg, 1996). E-mail is now used for communicating bad news and even conducting negotiations. Many people (McKinnon & Bruns, 1992) are scornful of those who use e-mail for purposes such as reprimands and firings. But some research now shows that e-mail may work better in communications that involve "dislike or intimidation" (Markus, 1994a, p. 136).

The establishment of e-mail and other communication policies involves sensitive organizational issues. For example, if one employee sends a printed memo to an employee in another department concerning a matter of interest to his/her bosses, it is often expected that the sending employee will send a copy of the memo to the bosses. Should the same policy hold for e-mail exchanges? Is e-mail more like a formal memo where such a procedure is expected or more like an informal phone call where copying is not done? Such policies will likely lead to debate and perhaps conflict. Generalist and information managers need to be actively involved in making these decisions.

COMPUTING AND EXTERNAL POLITICS

There are several ways in which computing can become involved with external politics. Here are some examples:

- Information technology is being used to determine the performance of governmental organizations as well as the presentation of these performance measures on websites. Access of the public to information about the performance of governments and other organizations (e.g., hospitals, health professionals) can often lead to controversy.
- Legislatures, councils, and boards of public agencies may contest the purchasing decisions of public organizations. Likewise, the award of computer contracts may involve political rewards.
- Public computer records are an attractive political source. The information could be used to schedule campaigns or find information that brings candidates into disfavor.
- Information systems often involve sharing amongst different levels of government as well as private organizations. Often there is conflict among these organizations over basic issues such as how the information system should be structured and what data they should gather.
- The rise of the World Wide Web and e-government have created the potential for politics. Political issues have erupted over the use of websites and other forms of CMC. A wide range of issues have developed, such as the use of websites to attack governmental officials or their use for advertising purposes.
- Major computer disasters or failures can bring negative attention to public organizations. These failures both hurt organizational performance and also threaten the jobs of staff.

Information Systems and Accountability

The development of computing technology has had an important impact on measuring accountability and presenting this information to the public. One of the major obstacles to the use of accountability efforts has been the argument that comparisons of performance are invalid—no two situations are the same. Consequently, organizations with poorer results have been able to point to factors that differentiate them from better-performing organizations (Rocheleau, 2002a). But now the use of computing allows sophisticated statistical methods to be applied that control for many of these differentiating factors. For example, the State of Tennessee has developed a "value-added" approach to assessing K-12 schools and teachers (Sanders, Sexton, & Horn, 1997). By employing the value-added approach, the advantages of richer, advantaged schools are eliminated and the results can be quite different (Sanders, Sexton, & Horn, 1997; Gormely & Weiner, 1999). Multivariate statistical models have been used to identify hospitals that have high and low rates of success in surgeries, and this information is now sometimes posted on the Internet (Gormely & Weiner, 1999). In state and local governments, the existence of powerful computer systems has allowed states such as Texas to monitor as many as 10,000 performance measures (Tucker, 2000A, p. 12). Prior to information technology, the ability to monitor such a huge amount of data would have been either too expensive or impossible. Thus, information technology may provide valuable information to consumers of services in making important decisions about what schools their children should attend and where to go for delicate surgery. The posting of information on the Internet makes this kind of information much more accessible than in the past when it would likely reside in obscure, hard-to-obtain governmental publications.

These increased external forces often lead organizations to adopt strategies for resisting information or manipulating it so that negative information is not available to the public or oversight agencies (Rocheleau, 2002a). For example, a recent US General Accounting Office (GAO) report (March 2002) found that abuse of nursing home patients was rarely reported. Indeed, colleges, universities, health maintenance organizations, and perhaps most organizations take steps to ensure that only positive information is reported via a number of strategies, especially if the information will affect high-stakes decisions (Bohte & Meier, 2001; Rocheleau, 2002a). Information is power, and the demand for more external access to performance information makes the job of information management even more political. Now that this information is so accessible, organizations have to deal with demands for access to more information, while other units may resist such demands, and power struggles over information ensue. For example, the Tennessee teacher unions successfully resisted efforts to make public the scores of individual teachers based on the value-added system (Gormely & Weiner, 1999). Other consequences include the likelihood that the data may be "cooked" in order to demonstrate high performance (Rocheleau, 2002a) and the IT managers may face ethical issues concerning how to handle such situations.

Information Management and the External Politics of Purchasing and Privatization

Many city managers attempt to defuse controversies over the purchasing process by involving council/board members in developing the proposals. Thus, decisions will not be brought up for decision until strong council/board support exists. Achieving such a consensus may be more difficult these days because board members are more likely to be involved with computing in their own organizations (e.g., Pevtzow, 1989). When computing was restricted to mainframes and data processing departments, council/board members were less likely to feel knowledgeable and able to challenge purchases. Rocheleau (1994) found that there could be conflicts over purchasing, even if there is a consensus on what type of technology to use. There may be tensions about whether to purchase from local vendors versus outside vendors.

The move to privatize information systems can create external conflicts with legislative bodies as well as unions. For example, the State of Connecticut's administration decided to sell the state's entire system from mainframes to the desktop and hire an external vendor to handle every aspect of the information function (Daniels, 1997). Later, they decided against the outsourcing because of a number of factors such as disputes with the state legislature and the union representing the IT employees, as well as reappraisals of the proposed contracts. Several other states have considered privatization, including Indiana, Iowa, and Tennessee. In order to implement such plans, the managers will have to negotiate with legislatures and unions in order to negotiate agreements. For example, the Connecticut administration (Daniels, 1997) moved to assure jobs of the state IT workers for a period of two years at the same salary and benefits in order to have the privatization move approved. In more recent times, the cities of Memphis and San Diego have moved to outsource their entire information services function. The absence of unions has facilitated the privatization of the Memphis operation (Feldman, 2000). However, as we have seen above, effective communication and political skills are required for an effective IT system, and the turning over the entire operation to a private vendor could disrupt the communication patterns and power relationships necessary for the system to work smoothly. That is why in many cases, the selected vendor often is an organization consisting of former employees or, as in the Memphis case, the winning vendor is expected to hire employees of the former municipal IT department (Feldman, 2002).

Although privatization may be used to achieve positive goals, it can also be used for political rewards and result in problems. One such example occurred recently when a computer vendor, Management Services of Illinois Inc. (MSI), was found guilty of fraud and bribery connected with the State of Illinois awarding a very favorable contract to them (Pearson & Parsons, 1997). MSI had legally donated more than $270,000 in computer services and cash to Illinois Governor Edgar's campaign. The jury found that the revised contract had cheated taxpayers of more than $7 million. Campaign donations as well as the flow of governmental and political staff between government and private vendors can influence the awarding of contracts.

At the same time that many states and municipalities are exploring privatization of their information management function, there are several municipalities that are moving to become telecommunication owners, and that leads to political controversy. For example, Tacoma's (Washington) municipal power company is aiming to build and provide cable services to homes and thus put it in competition with the local phone and cable companies (Healey, 1997). Many other cities including several small communities such as Fort Wright (Kentucky) are also planning to build telecommunication networks (Newcombe, 1997) in the US and are also providing telecommunication services for businesses and private homes in their communities. The rationale behind these moves is that the private cable and local phone companies have a poor record of providing up-to-date service (Healey, 1997). These moves have often been labeled as "socialism" and opposed by the local cable and/or phone companies. But, in the Tacoma case, most local business leaders are backing the municipality because of the desire to have better technology (Healey, 1997). Some states (e.g., Texas, Arkansas, and Missouri) have prohibited municipal organizations from becoming telecommunication providers (Healey, 1997). The state of California is in the process of privatizing its state telecom system (Harris, 1998). But, in Iowa, many municipalities have been laying fiber to deliver cable in competition with cities, and the first suit brought by a phone company was found in favor of the municipality (Harris, 1998). Although many information managers prefer to avoid controversy, telecommunications issues such as cable and access to the Internet have become so central to legislatures, councils, and the public that it will be difficult to avoid making politically sensitive decisions.

Computer Disasters and Information Management

It is likely that the majority of computer problems and disasters remain unknown to the public and even legislative bodies. However, certain disasters have so much impact on key operations that they do become public and create crises for generalist and information managers. For example, the delay in the opening of the new Denver Airport was due to software problems controlling the baggage system for the new airport. Likewise, the State of Illinois Medicaid program encountered many failures of the computer system with the system assigning patients to inappropriate health care providers (Krol, 1994).

Many disasters are beyond the control of managers, and there is little they can do other than plan for emergencies. However, in many cases, disasters appear to result from overly high expectations for new computer systems and a lack of understanding on how difficult it is to implement a new system. This author has reviewed a large number of computer problems and failures (Rocheleau, 1997). Both the Federal Aviation Administration (FAA) and Internal Revenue Service (IRS) have experienced major failures that have led to threats from Congress to defund systems (Cone, 1998). Another example is the State of Florida's new human services system that encountered much higher-than-projected costs and slower-than-expected implementation (Kidd, 1995). The perceived disaster led to the loss of job of the state official in charge of the new system along with threatened legal action. But over the long run, it appears that the system actually worked and has helped to reduce costs. Information management officials need to ensure that executives and the public have realistic expectations of system costs and performance. Computer problems and disasters are likely to occur more often as computing becomes central to governmental performance and communication with its constituents. In these situations, managers cannot avoid dealing with computing even if they have removed themselves from any decisions concerning it.

In contrast to the disaster cases, some politicians and managers make use of notable achievements in computing to boost their reputation for innovation and effectiveness. However, it can be dangerous for politicians or managers to claim success for large-scale new systems until the systems have been fully implemented and tested. For example, State of Illinois Comptroller Loleta Didrickson introduced a powerful new computer system that was aimed at speeding the issuance of checks as well as improving access to online information during June of 1997 (Manier, 1997). But soon afterwards, there were complaints that checks were arriving behind schedule and that matters had not improved (Ziegler, 1997). The agency stated that it was just taking time for workers to get used to the new system. The lesson for managers is clear: new computer systems that are large-scale and introduce major changes usually experience significant startup problems, and claims of success should be muted until success can be proven.

Information Management and Interorganizational Struggles

Many of our largest governmental programs involve complex arrangements where administration and funding are shared by federal, state, and local governments. These governments are often at odds over how they view information systems. For example, the welfare reform legislation passed in 1996 led to needed changes in how state and local governments gathered and analyzed data. Since welfare recipients move from state to state, the new welfare time limits require states to share and redesign their systems so they can calculate time periods on welfare and whether a recipient has exceeded state or federal limits (five years total and two years consecutively for federal limits). Prior systems were oriented to yearly information and were concerned only with welfare activities in their own state. The federal government has established data reporting requirements that many states view as burdensome and unnecessary (Newcombe, 1998). For example, they have to monitor the school attendance of teen-age mothers, and that requires sharing of information with independent local school districts. The quality of the data submitted by the states is also an issue (Newcombe, 1998). The very purposes of the federal and state systems can be somewhat at odds. The federal government wants to use the system to determine the overall success of the program and to be able to compare the performance of states. The state governments often are opposed to the increase in the number of data elements required from 68 to 178 and the costs of gathering much new information (Newcombe, 1998). Similar disagreements can occur between state and local governments with the latter often feeling that states are too autocratic in how they implement information systems. The resolution of such disagreements will involve conflict and bargaining with creative solutions sought that meet the primary needs of all involved.

Schoech et al. (1998) provide a case study of a volunteer group in Arlington, Texas who tried to create a databank aimed at helping reduce alcohol and drug abuse. This volunteer group "discovered the politics of information" (Schoech et al., 1998). Hospitals opposed the identification of drug-affected births by hospitals. When agency personnel changed, permission for access to the data had to be obtained over again. Changes in the structure of government and functions of office also led to the need to start again. They found that data gathering was not a high priority for other agencies involved, and access to data was often delayed or not forthcoming.

The Center for Technology (CTG) in government has conducted several case studies concerning the development of information systems that require the cooperation of several organizations. One case study involved the development of an information system for the homeless. First, several different actors needed to be involved in the development of the system including the New York State Office of Temporary and Disability Assistance, the Bureau of Shelter Assistance, the New York City Department of Homeless, the Office of Children and Family Services, the Department of Health, the Department of Labor, the Office of Alcohol and

Substance Abuse Services, the Division of Parole, and many independent nonprofit organizations that contribute to and use information on the system. The huge number of actors meant that the development of the system had to be very deliberate, and the first priority was to develop a sense of trust amongst them before the system could be built (CTG, 2000). Confidentiality of the information was a major obstacle and especially important to organizations representing women who had suffered from domestic violence. The new information system was to be used to help set goals and thus affect evaluation. Consequently, there were issues that had to be settled about how ambitious to make goals. There were many problems with data quality, and consensus had to be forged on key definitions such as "date of admittance" into the system because these definitions were important to funding (CTG, 2000). Some agencies wanted a more detailed listing of ethnic options than others due to their federal funding requirements (CTG, 2000). The staff (10 people) spent seven months just on the discovery phase of the system, and they found that contextual knowledge was imperative at this stage and that building of trust must come first.

Another CTG (1999) study concerned attempts to build integrated criminal justice systems. They found many conflicts over budgets, organizational relationships, and procedures. CTG (1999) concluded that these problems were not technical in nature but due to "conflicting visions" related to organizational and political interests. They found trust, participation, and understanding of the business were among those elements required for success. To achieve buy-in, they had to pay much attention to "interests and incentives" and use marketing and selling techniques. Political pressures played an important role in some cases. They found that "turf is the biggest killer of integration" (CTG, 1999, p. 11):

> *Protecting turf can be particularly important when the potential loss of autonomy or control could benefit other agencies that are political or institutional adversaries.*

There was also a need for a champion of the system who had major organizational or political influence that allowed this person to overcome the political barriers to integration. Finally, as with the homeless system, a strong knowledge of the "business" was essential. Bellamy and Taylor (1996) found very similar results in their review of attempts to create criminal justice systems in England. Although technical skills are always useful and sometimes essential, the development of successful interorganizational systems necessitates major use of political skills and resources.

In some cases, use of computing may help to reduce the amount of *ad hominem* politics and give more attention to the underlying facts of cases in development decisions (Dutton and Kraemer, 1985). They found that the computing models did not eliminate politics. Developers and anti-developers employed competing models with different assumptions. But the focus on the computer models helped to direct attention to facts of the case and away from personalities and unverifiable assumptions, thus facilitating compromise and agreement.

Information Management and the Politics of Databases

Most information managers prefer to avoid the release of information with political implications. But often they cannot avoid releasing such information and need to have a defensible policy in this regard. The New York State Attorney General's Office (Yates, 2001) plan to track flows of donations to victims of the September 11th tragedy was resisted by organizations such as the Red Cross due to privacy and confidentiality issues. Freedom of Information Act (FOIA) requests cover computer records in most states. Issues of privacy and public interest often collide and managers are often forced to make difficult choices. Although these problems existed prior to computers, the existence of computing has made it possible for outsiders to conduct very detailed critiques of the practices of public agencies with emphasis on pointing out their failures and questionable decisions on the part of public agencies. For example, the Chicago Tribune did a reanalysis of computerized information from the Illinois Department of Public Aid to do an exposé of fraud and waste in its Medicaid system (Brodt, Possley, & Jones, 1993). The extent, magnitude, and speed of their analysis would have been impossible without access to computerized records. Consequently, it is not surprising that many governmental agencies resist FOIA requests. A series of articles (e.g., Mitchell, 1999) by the *News-Gazette* newspaper in Illinois revealed that many resist FOIA using a variety of reasons such as the fact that they don't have to create a new document. The existence of a good computerized system can serve to weaken the argument that the obtaining of records would pose too great a burden on the governmental agency.

Generalist and information managers picture technology as a way to better services, but they should be aware that the same technologies and data bases can be employed for political purposes. For example, many municipal and state governments are now constructing powerful geographic information systems (GIS) that are aimed at improving services to citizens through the mapping of integrated databases. However, GIS systems and their data are now being used for "cyber ward heeling" in the 1990s and facilitate such traditional functions like the mapping of volunteers, canvassing of voters, and location of rally sites (Novotny & Jacobs, 1997). Politicians are likely to seek data from these public information systems to conduct their political campaigns. For example, databases allow the targeting of campaigns so that candidates can use several different messages and conduct "stealth campaigns" without alerting their opponents. Thus, the more powerful and information rich that local GIS systems become, the more attractive they will be as databases for political activities, which could lead to controversy.

Online Computer-Mediated Communication

The impact of the World Wide Web has especially important implications for politics. Researchers such as Robert Putnam (1995) point out a substantial decrease in some forms of civic participation on the part of the public. Many people are frightened to speak at public hearings. The Web offers a way of increasing public participation in community decisions (Alexander & Grubbs, 1998). Many people see us entering a new age of cyber democracy (Stahlman, 1995). Shy people and stutterers would be able to provide testimony electronically, and their arguments would be judged based on content rather than their appearance or public- speaking skills (Conte, 1995). Municipalities may help to develop useful networks such as senior citizen discussions. Parents can use the system to update themselves on student homework assignments. But, as noted above, there are several drawbacks to teledemocracy and development of interactive Internet applications:

- There is less inhibition in telecommunications than in-person communications against intemperate statements. Consequently, electronic forums often degenerate into "flaming" wars. The originator of the Santa Monica (California) online discussion system argued that, if he were to do it over again, he would like to have a moderator for the system and charge user fees (Conte, 1995; Schuler, 1995).
- Some people lack the computing technology and/or skills to participate in these electronic discussions (Wilhelm, 1997).
- It is feared by some that easing access to public testimony and input to public officials may result in such a massive and discordant amount of input that democracy would be stymied and that gridlock would increase.
- The Internet raises fears about privacy. Efforts to improve access can often lead to resistance. For example, the Social Security Administration (SSA) made interactive benefits estimates available over the Internet but was forced to withdraw the service due to privacy issues (James, 1997; United States General Accounting Office, 1997). Social security numbers are not very private, and all someone needed was the number plus the recipient's state of birth and mother's maiden name to gain access to earnings and benefits information.

- Public online systems may become campaign vehicles for certain politicians.
- A detailed account (Schmitz, 1997) of a discussion group concerning homelessness on Santa Monica's PEN system made the following points about the successes and failures of online groups: (1) The discussion group was successful in bringing together for discussion purposes people on an equal basis who would never have exchanged in face-to-face meetings; (2) but electronic media demand keyboarding and writing skills. Thus there are many obstacles to the successful participation of the poor. One recent study by Gregson (1997) found that even politically active citizens were not able to transfer their activism to a community network without substantial training and experience. It is instructive to look at the City of Santa Monica's online telecommunications plan and how it seeks public involvement. They employed a community survey, focus groups, and interviews with providers of communication services to solicit input. They found the computer penetration at 60 percent. In the future, it is likely that governments will construct formal plans concerning the Internet and submit these to the public for comment. Such plans are no longer just relevant to technicians and government officials.

Both generalists and information management staff need to give careful consideration to the possibilities and drawbacks of teledemocracy. If they decide to support electronic discussion groups, should they employ a moderator and, if so, who should act as a moderator? Would a moderator's censoring of input be a violation of the right to free speech? Fernback (1997) argues that most people accept moderation not as "prior restraint but as a concession" for the good of the collectivity. How can the argument that teledemocracy is elitist be handled? Is the provision of public places (e.g., in libraries) for electronic input sufficient to deal with this objection? Will input via the Web result overwhelm public employees and officials? How will public employees allocate their workload—should they give equal priority to electronic as to in-person or phone requests or treat them as of equal importance? In this author's experience, I have found strong resistance to the establishment of online discussion groups. Many governmental officials believe that such communication is likely to result in contentious and strident behavior. Many also feel that increased participation would slow down and make governmental decision making more difficult. Thus, West's (2001) finding that few governmental agencies allowed interactivity such as the posting of online messages, much less online discussion groups, may not be merely the result of their lack of technological sophistication but may also be due to a calculated reluctance to sponsor CMC.

The Politics of Website and Other Online Information

The creation of websites has created a whole new set of opportunities for politics to occur. What kinds of information should be online? Who should decide what information should be online? These are issues that have been highlighted by the web. Before, most public information resided in reports that few had access to or even knew existed. The ease of online access has changed that situation. As a result of the events of September 11th, some US agencies have pulled data from their websites such as information on hazardous waste sites. To many these actions make good sense, but others have pointed out that the chemical industry has tried to keep such information private and that public access to this information can help to save lives (Ruppe, 2001). The New York Attorney General's office began to develop a database to track the distribution of money donated to victims of the attack, but the Red Cross raised privacy concerns (Yates, 2001). Websites are sometimes used to attack government officials. A US Geological Survey contract employee was allegedly fired for posting a map on the US Government website that identified areas of the Arctic National Wildlife as moose calving areas that the Bush administration would like to open to oil exploration (Wiggins, 2001). In another example, a website was set up by a DeKalb, Illinois resident to look like the official DeKalb municipal website, but it was used to criticize city employees for alleged misconduct (Rickert, 2002). Other battles occur over issues such as advertising. Should advertising by private businesses be allowed on governmental sites? Many governments are resisting advertising, but some of the most successful, such as Honolulu (Peterson, 2000), have used advertising to fund advanced electronic governmental systems. Few others have followed. Honolulu put out a banner for a bank on its website. Peterson (2000) cites other governments as either being interested in advertising or not depending on whether they see it as necessary for funding. Decisions about opening government sites to advertising will involve ethical and practical issues.

Even decisions about what links to have on websites can become involved in political and legal controversy. For example, a court case was brought by an online newsletter (The Putnam Pit) against the City of Cookville, Tennessee due to their failure to provide a link to the newsletter despite the fact that several other for-profit and non-profit organizations were linked to the city's website (Anonymous, 2001). Many governments avoid making such links. The consensus is that if governments do make links, they need to have a carefully thought-out (nonarbitrary) policy for doing so.

CONCLUSION

Failure to become engaged and knowledgeable about internal politics can undermine the efficacy of information managers. I know of cases where managers with good technical skills lost their jobs due to their failure to master organizational politics. Information managers need to negotiate, bargain, dicker, and haggle with other departments. They may need to form coalitions and engage in logrolling in order to achieve their goals. A good information manager needs good political skills to be effective. I have drawn from a number of resources to illustrate the politics of information management, but there exists little systematic research concerning the topic, as Strassmann (1995) has pointed out. We need more research concerning the crucial issue, both in-depth qualitative case studies as well as surveys concerning how managers employ politics in their dealings with information technology.

The lessons of my review are clear: generalist managers can no longer afford to ignore IT. IT managers can no longer afford to ignore politics. Internal political issues such as those I have discussed above (structures, purchasing, sharing information, and electronic communication) have become so central that managers will find questions about these issues demand attention and decision. External political issues will continue to grow in number and importance as the Web and cyberpolitics become more prominent. For better or worse, information managers are going to have to possess effective political skills.

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Chapter III

The Evolution of Information Technology Management at the Federal Level: Implications for Public Administration

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ABSTRACT

Federal agencies rely extensively on information technology (IT) to perform basic missions. Arguably, public administration should be driving the theory, policy, and practice for managing these increasingly important resources. This is especially true as public organizations move to electronic government.

Despite some maturation in the literature for managing IT in federal agencies in the last several years, public administration has contributed little to this effort. Other academic fields, such as information science, business administration, and practitioners from the federal government and related contractors have contributed more recently to the theory and practice of IT management at the federal level than public administration.

This chapter analyzes federal IT management literature from several academic disciplines and government documents. The analysis compares federal IT management with a normative model of management maturity focusing on the strategic objectives for IT and related management approaches. Public administration's minimal contribution to federal IT management raises profound questions whether federal agencies are performing commensurate with public expectations in an information age.

INTRODUCTION

Given the growing importance of effective information technology (IT) management to the basic functioning of most public programs, the sophistication of the policy, theory, and practice in this area should be evolving quickly. Unfortunately, that is not so (Holden, 1996; Holden & Hernon, 1996; Fountain, 2001). As a result, it is quite possible that the current generation of public administration scholars and practitioners may be ill equipped to face the challenges of the information age in which we find ourselves trying to govern.

A mere gap in IT management theory might not be fatal; but in reality, the implications for the practice of public administration, and therefore governance, are quite grim. Press accounts of the year 2000 conversion effort potentially causing chaos in air traffic control and other vital business interests present one example of how integral public sector IT has become to the safety and economic well-being of the country. While the billions of dollars currently spent by the federal government on IT make up an insignificant portion of the budget, IT underpins almost the whole budget directly or indirectly. Just ponder the implications to the government's cash flow if the Internal Revenue Service could not collect taxes or the Social Security Administration could not post employee earnings.

This chapter compares the federal IT management literature with a normative model of management maturity, examining the strategic objectives for IT and the related management approaches. The academic disciplines that contribute to an understanding of the management of IT in the federal government include business administration, state and local government management, information sciences, and public administration. Although the analysis of the literature does include government publications, it does not discuss the pertinent public law or government-wide policy (see instead Beachboard & McClure, 1996; Holden, 1994; Plocher, 1996).

Like public administration more generally, IT management draws on several different sources. Unlike other management topics in public administration, though, the literature covering IT management lacks breadth and maturity. The following quotation summarizes the state of the literature at the turn of the 21^{st} century:

> A century from now, social and policy scientists will look back with amusement and no small amount of condescension at the glacial pace with which social scientists moved to consider fundamental changes in information processing and their implications (Fountain, 2001, p. 10).

While the chapter documents some progress in the field in the last several years since a similar review was published (Holden, 1999), it also points to continuing shortcomings. It is particularly troubling that disciplines besides public administration are responsible for the few recent developments in IT management literature. Compared against the management maturity model presented below, there is clearly much work left to do.

A MODEL FOR INFORMATION TECHNOLOGY MANAGEMENT MATURITY

This analysis of federal IT management literature proceeds in an order that reflects the maturation of the strategic objectives for IT and the attendant management philosophy over the last forty years. As a normative standard, this analysis adapts a model of maturation of theory and practice that Donald Marchand (1985) first used for the field of information management (Holden, 1994). He identified four stages of evolution for information management, encompassing the 20th century.

This chapter adapts his model as an organizing principle in several ways. First, since this analysis deals with the management of IT, it does not include his Stage 1, which addresses the physical control of information before automation in the 1950s. Second, Marchand discusses the evolution of information management for five distinguishing characteristics: (a) precipitating forces; (b) strategic objective; (c) basic technologies; (d) management approaches; and (e) organizational status. This chapter stresses how strategic objectives for and management approaches to IT have evolved, placing little emphasis on the other three characteristics. Third, since Marchand covers information management, which is broader than IT management, the names for the stages differ.

Finally, the stages used to organize this chapter reflect the stage of development of the literature, despite the date of its publication. In contrast, Marchand demarcated his stages by time periods, assuming that all activities within a specified period of time conformed to the same stage of development in management.

Stage 1: Management Information Systems

This stage, which Marchand labeled "Management of Automated Technology," spans the 1960s through the mid-1970s. Then, business and public sector professionals often used the term management information systems (MIS) to describe IT. The management of technology dominated this era at the expense of management of information. Because the management of the technology was limited to the data center, there was little concern for relating those resources to other facets of management in organizations.

The management approaches for IT of this era reflected the isolation of the IT professional from broader functional and executive oversight. Organizations used IT to automate backroom operations, with the primary strategic objective being to improve the efficiency of clerical activities (Zuboff, 1988). Personnel in the data processing function took primary responsibility for the management of these resources and focused on the development of applications and systems. Typically, these systems consisted of applications run by data processing professionals in centralized processing facilities that consisted of mainframe computers. Users had few direct contacts with these systems other than to fill out punch cards, do manual key entry, and receive printouts from the data processing department. As a result, line functions in the organization rarely controlled their own computing resources (Ackoff, 1967).

The early MIS literature dealt almost exclusively with private-sector applications. It was not until much later that public administration adapted MIS literature to public-sector theory and practice. In 1986, Bozeman and Bretschneider articulated a case for a separate body of literature to address the unique information needs of public organizations. They proposed that this body of theory and practice fall under the heading of public management information systems (PMIS).

To support this argument, they asserted that MIS literature ignores variables external to the organization, such as the political environment and the annual appropriation process. The political control of public organizations, which entail uncertain and variable goals, means that public- and private-sector methods for establishing IT performance indicators differ dramatically. Though private and public organizations can acquire the same hardware and software, their different organizational environments require unique system design techniques. While this notion of PMIS brought attention to the use of IT in the public sector, it had limited applicability as a management approach. Instead of viewing IT as a strategic resource for public-sector organizations, this perspective examined the development of one application at a time.

Some public administration research on IT has examined the availability of IT at the state and local government levels. For instance, the International City Management Association (ICMA) (1986) surveyed local and county governments' use of computers several times. Kenneth Kraemer and his associates (1989) at the University of California have published several works resulting from the Urban Information Systems (URBIS) research project. These initial efforts addressed the use of IT in local governments, placing much less emphasis on the management of those resources or their strategic importance.

Building on the URBIS study, Norris and Kraemer (1996) did an analysis of the results of ICMA's 1993 survey of local government computer use. While based on more recent survey data, this study looked more at the adoption and use of IT at the local level than how those resources were managed. The authors did examine the degree of computing centralization and found a statistically significant relationship between population and the kind of technology deployed. Large cities were more likely to have deployed central systems (such as mainframes and minicomputers), and smaller communities were more likely to have deployed only personal computers.

Some theoretical work in evaluating information systems has surfaced nonetheless, which applies generally to public-sector organizations. Newcomer and Caudle (1991) provide some insights into how and why the evaluation of information systems in the public sector should go beyond mere return-on-investment criteria. In particular, they offer a framework for evaluation that includes qualitative and quantitative measures and recognizes the multiple uses of most public information systems. Although this framework does not help agency decision makers choose between competing projects, it, nonetheless, broadened the theoretical base for evaluating individual systems projects.

Stevens and McGowan's work (1985) presents an overview of information systems management for public administrators from the local to the federal level. Their book adapts contingency-based organization theory to explain how public organizations must process information effectively to respond to their environment. For the most part, the book focuses on managing single applications and makes illustrative points through the discussion of three case studies. Although it does cover a variety of topics, including management, policy, and technology, it does not provide an organization-wide or strategic view of managing IT.

Despite some maturation of the literature during the MIS stage, theory was apparently not meeting the needs of practice. There were two notable contributions to the literature during this period. First, an emerging view recognized that IT required broader management attention. Second, management approaches matured to recognize that private-sector IT management might not suffice for public-sector managers. Even in the private sector, the MIS philosophy fell prey to vocal criticism as the developers rarely interpreted user needs accurately; and even if they did, it took so long to write the programs to run the systems, the original user requirements changed. After corporate managers spent millions of dollars to buy and subsequently upgrade MIS that did not provide the expected results, this criticism became more widespread.

Frustration found a voice in John Dearden (1972), who wrote that MIS would never meet managers' expectations or needs. He asserted that "the notion that a company can and ought to have an expert (or a group of experts) create for it a single, completely integrated supersystem—an MIS—to help govern every aspect of its activity is absurd" (p. 92). After fixating on the technology and the life cycle, evidently organizations still did not build the information systems they needed. A new, broader perspective for managing IT emerged as an alternative to MIS in the early 1980s.

Stage 2: Information Resources Management

Ironically, the private sector did not lead the next phase of IT management theory. Stage 2 signaled the replacement of MIS with a theory of information resources management (IRM). The federal government ushered in this new state of IT management with the passage of the Paperwork Reduction Act (PRA) (1980). The PRA articulated a need for the federal government to manage information and IT as a resource, much like financial and human resources (Caudle, 1987). Though the PRA created requirements for managing both information and IT in the federal government, Marchand uses the term "IRM" to refer to a philosophy for managing IT more generally, as does this chapter.

IRM, as the Stage 2 perspective for managing IT, reflected change in both the technical and the external environments of organizations from the mid-1970s to the mid-1980s. Information technology began to move out of the data center with the arrival of minicomputers and the introduction of microcomputers. With this decentralization of computing power, management approaches had to shift from the data center to include user organizations. Strategic objectives for IT also changed as line organizations began to realize that they could use IT for more than just backroom functions. As a result, program offices often acquired their own IT when data processing organizations could not keep pace with their needs. These changes, combined with the increasing level of spending on IT in organizations, brought these resources to the attention of a broader range of managers (Marchand, 1985).

In response to the disillusionment with a management perspective focused on single applications mentioned earlier (i.e., MIS), private-sector organizations and business schools began to think more about how to tie together disparate systems to form an organization-wide perspective. Often, data processing organizations call such perspectives "architectures." This view represented a departure from the earlier philosophy of managing IT, because it assumed that systems existed outside the physical and management control of a central data center.

McFarlan and McKenny (1983) also took an organization-wide view of managing IT, which they called "the Information Systems (IS) function." Their work distinguished itself in recognizing that organizations, especially large ones, often manage many information systems projects at once. As a result, it dealt with issues arising from coordinating several systems projects, going beyond exerting life cycle management control over individual projects.

McFarlan and McKenny (1983) acknowledged that cultural (what they call "environmental") factors often determine the effectiveness of control mechanisms for managing information systems. These factors include: (a) the penetration of information systems in the working environment; (b) the level of maturity of information systems development efforts; and (c) the planning style of the organization. More specifically, McFarlan and McKenny asserted that the effectiveness of information systems planning depends on the perceived importance and status of the systems manager, the physical proximity of the systems group and the general management team, the corporate management style, and organizational size and complexity.

International Business Machines (IBM) (1984) developed a systems planning methodology called Business Systems Planning (BSP) that offered a framework for managing a collection of information systems across organizations. Specifically, BSP provided organizations, public or private, with a method for creating an information systems plan.

Experience has shown that BSP can be applied to all institutions in the public sector and all industries in the private sector, because the requirements for developing information systems are similar no matter the business served or the products and services provided (IBM, 1984, p. I). Even though BSP does not address the planning or use of individual systems, it does create a framework for linking systems planning to the broader purposes of the organization.

IBM's stated intent in creating BSP was to develop a methodology for creating a plan that would overcome the historic weaknesses of information systems implementation, generally attributed to a lack of planning. In part, IBM built on its own attempts to deal with the plethora of systems that each of its own functions had developed over time. The keys to this new method, as IBM espoused them, were using top-down planning and analysis of organizational processes, relying on bottom-up implementation, translating organizational objectives into information systems requirements, and using a structured methodology (IBM, 1984).

Consistent with IBM's view that BSP methods applied to public- and private-sector organizations, collections of articles on IRM issues appeared during this stage of the literature. For instance, Rabin and Jackowski (1988) edited a volume that touches on a variety of IRM issues, including information systems management, data administration, and applications such as decision support systems and databases. While sections of the volume dealt with public-sector IRM (Marchand & Kresslein, 1988), the balance of the work was so general that applying it to any particular kind of organization is difficult. Specifically, it devoted little attention to federal government.

In response to a request from the House Committee on Government Operations, GAO's Information Management and Technology (IMTEC) Division (1992b) compiled a report that highlighted some problems it consistently found in federal agency management of information resources. It identified 11 themes across 132 agency-specific reports that spanned the period between October 1, 1988, and May 31, 1991. Of those 11 themes, eight dealt with IT management and two addressed agency-wide management and control of information resources, including IT and data management. GAO did not set out to find root causes to these broadly defined problems but did identify several plausible explanations in the report. For management mechanisms such as life-cycle management, project evaluation, and coordination of information resources, GAO found that agencies lacked sufficient policy controls or did not effectively use the controls that existed.

Based on its experiences reviewing agency-specific IT projects, IMTEC developed what it described as a generic framework for developing systems architectures. In the preface to the report describing this framework, IMTEC expressed hope that the framework would help to address a prevalent problem of agencies trying to manage IT projects, which is the lack of planning and analysis of alternatives. While this report provided a very high-level view of the steps an agency should consider in developing a particular systems project, it did not address how to provide cohesiveness to information systems efforts across the agency (GAO, 1992a).

To date, only two academic studies have addressed the implementation of the PRA by federal agencies. Caudle (1987) conducted the first study, documented in a report for the National Academy of Public Administration (NAPA). This report included the results of interviews with federal IRM officials in cabinet-level agencies, selected sub-agency organizational units, and the central oversight agencies. She used these interviews to learn how agencies had organized to meet the mandates of the PRA and to assess whether the principles contained in the act had begun to pervade agency attitudes and behavior. In addition, her study presented agency views on OMB and GSA's policy-making mechanisms for overseeing achievement in the PRA and the Brooks Act.

Caudle's work provided groundwork for subsequent public administration advances in IT management. In particular, she found that agency staff identified the strategic planning and budget processes as the "dominant IRM management control mechanisms." This attitude manifested itself in the respondents viewing IT management as guiding a project through the acquisition approval process at GSA and the budget approval process at OMB. In the conclusion to the report, Caudle recommended future research into control mechanisms for information resources. Such mechanisms, she noted, might differ from those used for financial and human resources. Additionally, her work serves as the foundation for GAO's Strategic Information Management study discussed later.

The second study, conducted by Levitan and Dineen (1986), also relied on interviews with selected federal IRM officials. This research differed from the Caudle's (1987) report for NAPA in that Levitan and Dineen first established a model of what they called "integrative IRM" and used that as a basis for assessing the state of the art of integration of federal IRM in 1985. In the authors' view, managing IT is complex because such management issues transcend normal organizational boundaries. Specifically, Levitan and Dineen cited strategic planning, implementation of technology, and interaction with the organizational constituencies as examples of integrative issues for federal IRM.

Having constructed this model of the integrative nature of federal IRM, the authors conducted interviews with representatives from several federal agencies and one bureau of a federal agency. They posed questions about whether managing information resources in the organization extended beyond information systems to include information management (e.g., functions such as dissemination and records management) and whether notions of IRM extended to the program offices.

The findings confirmed several of those cited by Caudle (1987) in her study published by NAPA. For the most part, agencies had not fulfilled the mandate of the PRA by integrating the management of information systems and information content. The federal IRM offices represented in the interviews cited the management of information systems as their major concerns overwhelmingly. This reflected the information systems background of those staff who had risen to management positions in IRM. Agencies relied on task forces to achieve integration of IRM issues across normal organizational boundaries. Levitan and Dineen found no consistent patterns of whether agencies had succeeded in integrating IRM as a management discipline in program operations.

Bishop, Doty, and McClure (1989) prepared a compendium of views on federal IRM from the two aforementioned studies, academic literature, and GAO, OMB, and GSA publications that went beyond just the carrying out of the PRA. Their paper presented a matrix of various observers' critiques on the status of IRM in the federal government. Comparing these critiques, they identified strong agreement on several points, such as: (a) insufficient integration of IRM at the agency level; (b) insufficient integration of IRM with agency mission and program management; and (c) a need for better planning. Only one index dealt with the management of IT, and the respondents split evenly on the issue of whether IRM suffered from an overemphasis on technology.

Several other contributions from information sciences bring more insight into state of IRM policy development and to some extent implementation. Beachboard and McClure (1996) point out some inherent inconsistencies among the various federal oversight bodies and policy instruments. To help deal with weaknesses in IRM policy they cite, Beachboard and McClure advocate changes in IRM policy, federal agency commitment to IRM as a management discipline, and further empirical research into the lack of effectiveness of IRM policy and practice.

A similar publication on federal IRM finds that neither policy nor practice seems able to bring federal agencies into the information age, thereby enabling wide-scale electronic service delivery (Bertot et al., 1996). Without much empirical grounding, the authors offer a mix of policy, organizational, and investment choices that they assert will enhance the effectiveness of federal IRM policy and practice. These contributions add a certain richness to an understanding of federal IRM policy but, despite some hints of loftier strategic objectives for IT (i.e., electronic service delivery), offer little in the way of concrete management process to make that vision a reality.

Consistent with the maturing view of IRM, the research on local governments' use of IT began to explore the benefits from investments in automation. An analysis of survey data collected from 46 US cities found that payoffs accrued in fiscal control, cost avoidance, and improved service delivery mechanisms. This study also found that it took longer than anticipated to realize some benefits and that expected payoffs in better information for management and planning had yet to appear (Northrop, 1990).

Other research has included IT management as part of an examination of IRM in state governments. The Syracuse University School of Information Studies (1989) produced a nationwide study on the maturity of IRM in state governments. This study used data collected from a survey of 2,200 program managers and information systems directors to characterize their views on the state-of-the-art across several IRM activities, including IT usage and acquisition. It did not, however, discuss management techniques for IT or the strategic role of IT for stage governments.

At the county level, Fletcher and Bertot (1993) examine the extent and impact of centralization of information services. The article is a based on a national survey of the largest 450 counties in the US, supplemented with case studies of 13 counties, ranging from very small to very large. The survey gathered data on the extent of user agency versus central IT department equipment ownership, IT operation, network configuration, software development strategies, and the operation of "office systems." The analysis of these data reflected the shift of role of the central IT organization from controller of all IT resources to provider of resources. The authors called this a collaborative model between central IT and user organizations and asserted these data support a finding that county governments were succeeding at IRM while federal agencies were not at that time.

A consistent theme emerges from the literature of Stage 2, covering IRM. The application of theory and practice from this era has been very uneven. The federal government, in particular, still relies extensively on centralized, mainframe information processing and a similarly centralized management approach, which does not support the sharing and integration envisioned by IRM proponents. A lack of agreement on the meaning and relevance of IRM, as manifest in the publications advocating continued changes to basic federal law and government-wide policy for IRM, continues to thwart the adoption of the core management principles. This may be in part because researchers outside public administration, most notably information sciences, have done most of the research on IRM policy. What little research there is on IRM implementation points to mixed results at best and is mostly still exploratory.

The strategic focus for IT remains largely the same—efficiency. Although efficiency of government service delivery to the public, as compared with the efficiency of just backroom functions, represents some progress, the ultimate goal remains lower costs. These notions of IRM as a management philosophy and strategic focus for IT remain mostly inwardly focused to the organization, except for preliminary discussions of electronic service delivery. Despite, or perhaps because of, the limited success of IRM, a new era for managing IT has begun to emerge.

Stage 3: Managing Information Technology in an Information Age

While many organizations strive to make the transition from Stage 1 (MIS) to Stage 2 (IRM), further developments in managing IT are forming the outline of a new stage. Marchand calls this stage "knowledge management" to highlight the shift in emphasis from the physical management of technology and information to the management of information content. Although there is now considerable interest in the area of "knowledge management" as a field of study and practices with the information systems field, Marchand's use of the term has a narrower meaning than we now generally find. He contends this stage of development began in the mid 1980s and will continue through the 1990s. While the management of information content is emerging as a new skill, the successful application of IT makes it possible to maximize the benefits of information content (Marchand, 1985).

At the outset, though, a more precise definition of the term "information age" is in order. "Information age" has crept into the day-to-day language used in most organizations and the popular press. It is generally used to describe a future state where information will be quickly and universally accessible in electronic form. Dizard (1985, 1989) described his view of an information age but implied that our society has not yet arrived there. The mature phase, which he believed would arrive in the 1990s, would entail the mass availability of IT and technology-based information services to consumers in their homes. This third stage would be made possible by the existence and use of a broad network of networks for sharing information between individuals—not only large organizations and businesses. Many of these new services would be made available, not through the personal computer, but with existing appliances in many homes—the television and the telephone. To a great extent, this third stage of the information age is becoming a reality quicker than even Dizard might have envisioned. For that reason, this part of the chapter uses that description of the term "information age" to help frame the most mature management philosophy for IT.

As an indication of how powerful the notion has become, the Clinton administration described an information-age initiative promoting new uses for IT in federal agencies (Office of Science and Technology Policy, 1993). This report brought a new strategic focus to the uses of IT for federal agencies as a service delivery vehicle, requiring new management approaches and supporting policies. The Clinton administration envisioned the federal government will use IT to make agencies more responsive and service-oriented. Instead of using automation to make government operations more efficient for internal processing, agencies would use IT to reach out the public to provide more timely and higher quality service.

Comparing differences between an information age philosophy and IRM point to the maturation of management approaches for federal IT management. One difference is a more robust understanding in the information age of how important the technological infrastructure is. Emerging and maturing technologies such as graphical user interfaces, client-server computing, and workstations create a foundation for more substantial user involvement in information management. Additionally, this reality requires recognition that technology cannot be managed effectively from the mainframe data center to the exclusion of management of the desktop and everything between.

Corporate information management (CIM) is among the most prominent additions to the literature on how to manage information systems from an organization-wide perspective. Although the Department of Defense (DOD) made the CIM acronym well known in the federal IRM community, many CIM ideas come from Paul Strassman's experiences in the private sector. Strassman served on the Executive Level Group (ELG) for Defense Corporate Information Management, which created the charter for CIM (Executive Level Group for Corporate Information Management, 1990). This document mirrors many facets of a 137-item policy checklist found in Strassman (1990), which is based on the private-sector work he did before coming to the Department of Defense.

Several themes emerge from Strassman (1990), extending the IRM view of managing information systems from an organization-wide perspective. He stresses that the policies for managing information systems should place responsibility in the hands of the users—not the IRM specialists. These policies include: (a) using economic analysis that promotes trading off between information resources and other resources; and (b) providing mechanisms that charge users for information and information systems. He also introduces the notion that organizations should examine and redesign work processes before automation to ensure that automation does not speed up archaic and unneeded functions. The unifying theme presented by his list of policies is to ensure that investments in information systems add measurable value to the core missions of the organization.

Without identifying it as such, Strassman's approach of aligning information resources to organizational missions falls under the rubric of strategic management. Strategic management represents an effort by private- and public-sector managers to make strategic planning more useful in meeting the short-run needs of organizations. Much like Strassman, business authors writing about strategic management talk about aligning corporate resources and missions to take advantage of opportunities in the market. Strategic management emphasized looking at resource allocation processes and support systems to see how they added value to a business (Hax & Majluf, 1984). For use in the public sector, public administration authors have adapted these models for differences in civil service traditions in political environments (Nutt & Backoff, 1992). Some public-sector models of strategic management explicitly include and highlight the role of IT in strategic management processes (DeLisi, 1990; Adler, McDonald, & MacDonald, 1992).

An analysis of a national survey of public managers' views of IT issues provided further insight into differences and similarities between public- and private-sector management in this area. Caudle, Gorr and Newcomer (1991) compared the results of a 1988 survey of managers in federal, state and local agencies to similar studies of private sector organizations. The comparison of the public sector survey to the previous survey of private-sector managers found that seven of 10 top issues are common between the two groups. The authors found some differences in the relative ranking of the issues, leading them to conclude that the public sector was still grappling with some issues that private-sector organizations had been able to deal with more quickly. For instance, public-sector respondents ranked issues as integration of technologies and end-user computing as high priority issues where their importance had been declining over time for private-sector managers. They did find that both groups rated the issues of aligning IT with agency goals and IT planning near or at the top of their respective lists, indicating that a strategic orientation was beginning to take hold in the public sector.

GAO (1994) has taken a more preventive approach to dealing with federal agency problems managing IT and grounded it in the literature of strategic management. In doing so, GAO not only presents a new management approach for IT grounded in systematic research, but it also brings the new strategic objective of mission performance into discussions of why the successful management of IT is so important. Within the federal IRM community, GAO's work in this area often goes by the label of its "best practices" study (Caudle, 1996).

Part of what separates this GAO effort from "typical" GAO reports is the rigor of the analysis supporting GAO's recommendations for change. GAO went to some lengths to find case study examples of effective IT management practices in both the private and public sectors and included federal agencies beyond state governments. Throughout the process of deriving the key best practices from the case study research, the GAO team consulted with federal IRM executives and oversight organizations such as Congress, OMB, and GSA to help ensure that the practices were applicable in the federal environment. As part of the case study analysis, the research also went to great lengths to point to empirical proof of improved mission performance resulting from or at least relating to the application of the best practices.

While not explicitly linking the research or the findings to a particular body of literature, it becomes apparent from viewing the list of practices that GAO has created a strategic management framework specifically for managing IT. The practice GAO advocated are: (a) directing IRM changes; (b) integrating IRM decision making in a strategic management process; (c) linking mission goals and IRM outcomes through performance management; (d) guiding IRM project strategy and follow-up through an investment philosophy; (e) using business process innovation to drive IRM strategies; and (f) building IRM/line partnership through leadership and technical skills (Caudle, 1996). Although some of the language and the term "IRM" pervade best practices report, GAO's work has clearly brought both federal IT theory and practice to another level of management maturity.

Compared with the model of management maturity posited earlier, GAO's research, the resulting report, and the associated toolkits contribute new viewpoints to the strategic objectives and management approaches for IT. The strategic objective for the GAO's best practices work is unambiguously clear with the discussion of both strategic planning and mission performance, grounded in related program effectiveness measures. In effect, this implies a life-cycle management approach to linking IT plans, investments, and results. The mission focus also becomes apparent as the management approach seeks high alignment of IT investments with strategic plans and greater partnership between IRM and program staff. An investment management philosophy, grounded in the budget process, gives the whole management approach "teeth" and helps to guard against the tendency for more traditional IT plans to lie unused.

One academic study examined federal agency implementation of GAO's SIM framework to assess how the practices from leading organizations, mostly from outside the federal government, were being implemented. Westerback (2000) analyzed data gathered from 20 case studies identified by the federal CIO council and the Industry Advisory Council in a report of federal IT management "best practices." By this time, most of the SIM framework had been codified into public law and government-wide policy [(see the Information Technology and Management Reform Act (1996) and the amended Paperwork Reduction Act (1995)] and supporting government-wide policy (i.e., the revised OMB Circular No. A-130) (OMB, 1994).

The study therefore examined whether the case study agencies were following the new laws and related policy and whether the practices were as relevant to federal agencies as GAO asserted. The analysis of the case study data found strong support in practice for three of GAO's eleven practices and support for the remaining eight. In addition to finding support in practice for the GAO SIM framework, the study identified another practice (modified acquisition practices) that the study organizations found key to success but was not included in GAO work. This study helps to ground this important work, initiated by a practitioner organization, in the public administration literature and also provide some much-needed external evaluation.

The Kennedy School of Government (Mechling & Applegate, 2000) is in the process of publishing a series of papers as this book goes to press that outlines "Eight Imperatives in a Networked World." The papers will include an overview document and a guideline paper devoted to each of the eight imperatives. The intended audience for the paper series is government leaders, although the findings and suggested practices are grounded in the literature of both public policy and business administration. The topics for the papers are: (1) Focus on how IT can reshape work and public-sector strategies; (2) Use IT for strategic innovation; (3) Utilize best practices in implementing IT initiatives; (4) Improve budgeting and financing for promising IT initiatives; (5) Protect Privacy and Security; (6) Form IT-related partnerships to stimulate economic development; (7) Use IT to promote equal opportunity and healthy communities; and (8) Prepare for digital democracy. Though not particularly deep in explanation, these guidelines provide a good overview of issues government leaders face in leveraging the full potential of investments in IT in the public sector.

One recent addition to the literature covers an IT management project that is quite unique to the federal government—mega projects. Bozeman (2002) uses the Internal Revenue Service (IRS) Tax Systems Modernization (TSM) as an extended case study to explore the challenges of deploying desperately needed IT and business modernization on a scale not often seen. In addition to probing whether TSM really was the complete failure generally depicted by oversight organizations like GAO, the author articulates some lessons learned for large-scale federal IT projects. While some of these lessons are unique to the IRS, they may well prove instructive to federal agencies seeking major systems and business process improvements in the coming years.

IS PUBLIC ADMINISTRATION READY FOR THE INFORMATION AGE?

Debating what constitutes *the* information age is not productive at this point. The administration of public programs reflects the reality of *an* information age. Various disciplines discuss federal IT management, but public administration's contributions continue to lack both depth and rigor. In particular, a small, albeit growing, body of public administration research has addressed the management of IT as a strategic resource for serving the public and improving program effectiveness.

It is quite apparent how integral IT has become to administering federal programs specifically and all public programs more generally. Relegating this management domain to "computer people" is no longer sufficient. Since governance is an information-rich endeavor, public administrators need to understand how to manage the infrastructure that collects, processes, stores, and disseminates information about and for public program delivery.

Most advancement in federal IT management theory, policy, and practice continues to come from outside public administration. In particular, business administration leads public administration in identifying the strategic role of IT in supporting organizational missions. Information sciences have done the most in-depth research into federal IRM policy. GAO continues to contribute greatly to the development of new federal IT management policy and practice, and the public administration literature is beginning to validate the efficacy of GAO's work in this area.

As documented by the minimal contributions to the maturing literature for federal IT management, public administration is only beginning to recognize the critical importance of IT to deliver public programs. Given the growing popularity and spending on electronic government, it raises issues of whether public organizations lack a sufficient management infrastructure for building new Internet-based form of service delivery. The depth and rigor of public administration research in budgeting, personnel, and organization theory compared to IT management points to a need to reexamine the core management competencies for public administration. The management of IT should be viewed as a competency as important as the management of human and financial resources within public administration.

Public administration should provide a vision for federal agencies as they move from a technology base and management philosophy grounded in concepts of management information systems and information resources management to a more mature notion of an information age. This more mature notion should recognize that as IT becomes even more widely available and used by the public, citizens will demand changes in the way they interact with their governments. Increasingly, the public will ask, if not demand, to "do business" with the federal government electronically. As a result, it is imperative that IT management theory, policy, and practice mature more quickly to enable the electronic service delivery the public will demand and the information age enables. It remains to be seen whether public administration will contribute to this maturation any more than it has in the past.

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Chapter IV

The Realities of the Paperwork Reduction Act of 1995: A Government-Wide Strategy for Information Resources Management

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ABSTRACT

The strategic management practices required for the use of information and information technologies under the Paperwork Reduction Act of 1995 (P.L. 104-13, 44 U.S.C. § 3501) comprise an important toolkit for federal agencies. There is a special need for strategic planning and management of information in an era of electronic government initiatives, homeland security, federal workforce retention problems, and inter/intra-governmental agency data sharing programs and systems. The PRA sets the policy agenda for information resources management in the US federal government and places the guidance and oversight for enacting the PRA in the Executive Office of Management and Budget (OMB). At both the level of guidance and practice, the PRA has had mixed success

since it was initially signed into law in 1980. OMB has not met its statutory responsibilities under the PRA, and the federal government is left without a cohesive direction and agenda for information resources management.

INTRODUCTION

The policy and practice of information resources management (IRM) has been a requirement for executive agencies of the US federal government since the passage of the Paperwork Reduction Act (PRA) in 1980 (44 U.S.C. Chapter 35; P.L. 104-13). This seminal act made information resources—information, technology, and personnel—be viewed and treated as a valuable government asset and managed in a life-cycle manner. The act was revised in 1986 with minor revisions and again in 1995 with major revisions, most notably its attention to strategic planning and strategic management of information resources. The passage of the Government Performance and Results Act of 1993 (GPRA)(Section 5501 of Title 15; P.L. 103-62) and the Clinger-Cohen Act of 1996 (P.L. 104-106) added support and strength to the recognition of the strategic value of information resources and the necessity of planning for their effective use.

The passage of the Government Paperwork Elimination Act of 1998 (GPEA)(Title 27; P.L. 105-277; 44 U.S.C.) lends further significance to strategic management of information resources with its mandate that federal agencies offer electronic government alternatives by fiscal year (FY) 2003 to citizens, businesses, and other government agencies who interact with federal government. These laws are designed to maximize government performance and efficiency, make top level agency heads accountable for their information technology (IT) management, insure privacy and security for both the information systems and the data maintained by federal agencies, to manage government information collections according to a life-cycle model, to provide public access to high quality government information and transactions, and to do all the above in an online environment by FY 2003 (Fletcher & Westerback, 1999; Fletcher, 2002). Such a major transition to a new technology environment begs for effective planning prior to making this move.

The need for polices to guide the management of federal information resources assumes even more importance in light of the $44.9 billion allocated to information technology in FY (2002) and the estimated $50 billion for FY 2003 (Executive Office of Management and Budget, February 2002). This investment in IT dollars makes the US federal government the largest purchaser of IT in the entire world. Yet there is an on-going history of evaluation work that indicates that the government still has many major challenges to overcome before it makes sound and cost-effective use of its information resources (GAO, April 3, 2001). Thus, a strategic management approach to designing the information infrastructure in a planned and focused manner becomes a necessary condition for IT funding. Large dollar investments in IT historically have translated in high risk; planning is a proven management tool to mitigate risk (Brown & Eisenhardt, 1998). The high risk attached to technology investments is not just a reflection of large investments. A recent report from the United Nations (2002) notes that the US government leads the world in using the Internet to deliver information and services to citizens—another example of the information-intense nature of government. The amount of resources expended to create, maintain, and disseminate information, and the role of the US as a global leader in this domain, add to the compelling arguments for attention to strategic planning (GAO, March 29, 2000).

The recent events of September 11, 2001, also play a key role in the argument for strategic planning. A body of work has been developed by the US General Accounting Office (GAO) (July 1, 2002), which is creating the framework for homeland security. It becomes evident, upon reading GAO reports and testimonies, that the complexities involved in developing and maintaining a homeland security program are many and varied. It will involve cooperation across federal government agencies and across levels of US government. Transportation, law enforcement, public health, emergency management, and food safety are just a few of the players involved in this mission. The tie that binds them together is information and information technology. The coordination and maintenance of a homeland security program is an effort that needs critical attention to planning if it is to be more than a crisis management effort. The management here of the information becomes the essential component to its success in maintaining a secure environment for the United States.

A report from the Senate Committee on Governmental Affairs (Thompson, 2001) highlights the management of information technology as an "urgent federal government management problem." One of the findings in this report is that:

> *Agencies are not using common sense to determine what computer systems they need, to manage their systems effectively, or to determine the costs of their systems. For example, 17 of 24 agencies do not follow the best practices used by the private sector to manage their major information technology projects. (36)*

This lack of attention to the management aspects of information technology leads to cost overruns of millions of dollars, projects that are years behind in implementation, and systems that, in the end, do not meet the needs of the end users. And most important, the information technology architectures of federal agencies are not aligned with the agencies' missions or goals.

Over the past 20 years, a number of laws, including those mentioned above, have been enacted in recognition of this problem and mandate strategic planning as a best management practice. Congress has put in place a statutory framework to improve the performance and accountability of executive agencies and to enhance executive branch and congressional decision making. Results-oriented management legislation, coupled with legislation mandating the reform of IT management practices, has enabled substantial progress in establishing the basic infrastructure needed to create accountable and high-performing federal agencies. The enactment of the PRA and other information-related laws represents an enormous challenge and risk to federal executive agencies.[2] This legal framework adds to the complexity of the information resources management processes, again arguing for a considered and holistic approach as represented by a strategic plan.

More than 20 years have elapsed since the original passage of the PRA. Yet there are consistent and troubling indications that the main thrust of the act has not been institutionalized in federal agencies. A recent report from the GAO (February 22, 2002) indicates that the Office of Information and Regulatory Affairs (OIRA) in the Executive Office of Management and Budget (OMB) has not given strategic IRM planning the guidance and direction required under law. The PRA stipulates that the Director of OIRA "develop and maintain a government-wide strategic plan for information resources management." This government-wide plan becomes the blueprint for federal agencies in the development of their own agency-specific IRM strategic plans. OMB has recognized the importance of managing information as a strategic government asset and set forth operational guidance in Circular A-130, Management of Federal Information Resources (52730-52751, 1985; revised 50 FR 52730, December, 1995; revised Transmittal Memorandum No. 4, November 28, 2000). In specific, the circular notes that:

> *Government information is a valuable national resource. It provides the public with knowledge of the government, society, and economy—past, present, and future. It is a means to ensure the accountability of government, to manage the government's operations, to maintain the healthy performance of the economy,*

> *and is itself a commodity in the marketplace. The free flow of information between the government and the public is essential to a democratic society.*

The definitions and guidelines assigned by the PRA illuminate the key constructs and government context of the act. The term *information resources* is defined by the PRA as "information and related resources, such as personnel, equipment, funds, and information technology." *Information resources management* is defined as "the process of managing information resources to accomplish agency missions and to improve agency performance." Strategic planning is also codified in law in the Government Performance and Results Act. A *strategic plan* is to cover a period of no less than five years and be revised at least every three years. It is to include a comprehensive mission statement including outcome-related goals and objectives for the agency's major functions. This high level focus on planning was developed in an effort to have federal agencies accountable to the public, results-oriented, and to aid federal managers in improving the service delivery to and satisfaction levels of their customers.

This chapter will examine the notion of strategy and the importance of strategic planning. It is framed by the relevant laws and guidance which directly affect US federal executive agencies. An evaluation of the role of OMB/OIRA in developing and maintaining a government-wide strategic IRM plan is presented. Recommendations for strategic planning in federal government will be offered as well.

ASPECTS OF STRATEGY

The word *strategy* is from the Greek, meaning to lead an army. In life and death situations, it makes sense to have a strategy to enable successful outcomes. The value of having a strategic direction and a plan for its achievement came to be an accepted business maxim in the 1960s. It was at this time that the body of knowledge on strategy and planning began to build rapidly (Thompson, Fulmer, & Strickland, 1992). The importance and use of strategy, however, has a much longer history, reaching back more than 2000 years with the teachings of Sun Tzu. He asserted that:

Strategy is important to the nation—it is the ground of death and life, the path of survival and destruction, so it is imperative to examine it. There *is a way of survival, which helps and strengthens you; there is a way of destruction, which pushes you into oblivion.*

This sentiment is especially relevant in a post-"nine-eleven" world. Government is faced with new threats and complexities, often enabled by ubiquitous computing networks, and must respond quickly, yet in an accountable manner. Government today continues to have to make do with fewer resources to accomplish more objectives. Competition for scare resources is an annual government challenge. To work without an effective formal strategy is to sail without a rudder. A strategic plan can not only be an instrument of survival, but further, be a means to success for an organization.

Dimensions of Strategy

Formal strategies and their attendant plans imply a deliberate procedure, one that is *a priori* in nature. According to Mintzberg and Quinn (1991) there are three necessary elements to an effective strategy: a delineation of the strategic goals to be realized, an articulation of the policies which facilitate or limit the ability to be strategic, and a determination of the critical programs necessary to carry out the organization's strategy, In addition to these necessary elements, other dimensions are relevant to the design of a good strategy and plan. Strategies should be focused on those few important directions which an organization deems as essential. Strategies must also incorporate the notion of an uncertain and basically unknowable future: a future that will have an unpredictable impact on an organization. Thus, the organization must craft a strategy that builds a strong posture or stance from which to respond to the external uncertainties, which will affect it in unknowable ways. Strategies should be developed in a hierarchical manner with higher level strategies informing the lower level ones, and the lower level strategies supporting the enactment of the organizational strategy and mission. Finally, strategies should push the limits of an organization, forcing them to look at the world, and themselves, through a new pair of glasses. The limits of incrementalism and the realities of our networked and virtual word argue that small changes at the margin, and doing things the way we have always done them, is no longer an adequate mechanism for survival (Mintzberg, 1987; Hamel, 1996; Kaplan, 2002; Porter, 2002;).

Organizations build their strategic plans around certain positions or foci. These positions serve to carve out a niche for the organization and to define the focus in either a broad or narrow manner. Porter (1996) delineates three distinct sources from which strategic postures can emerge. These postures are not independent and often can be seen to occur in conjunction with each other. First is the "variety-based" posture, one that is defined by the service or product that the organization chooses as the focus of its attention. This could be a strategy represented by the goal of manufacturing the best-quality high-end workstation, or providing low-cost accessible higher education to customers through the Internet. The second posture is "needs-based," i.e., the organization directs its attention to meeting a range of needs for a select customer segment. This is the most likely posture for a government agency. There is a definable population—US citizens—with service and information needs that the government is mandated to provide. Third is the "access-based" position whereby the customer base is segmented into categories that reflect differing subsets of needs. Government services also can come under this posture. An example of this would be a strategic targeting of rural versus urban customers or children, homeowners, women, and the like. A definition of specific user needs and habits serves to inform this kind of strategic posture.

Organizations need strategies to set direction, or minimally, keep them from harm in uncertain environments. A strategy gives meaning to an organization. It creates not only a plan, but a perspective for the organization. The strategic plan enables the organization to direct and coordinate the activities of its members, giving rise to a collective action that is based on a sense of mission. The strategy becomes the *raison d'être,* with the plan itself being the tool for organizational enactment.

Strategy and the Public Sector

An important distinction to consider for government in any formulation of strategy is the significance of being a public organization. Bozeman (1984) and later Bozeman and Straussman (1990) created a model of publicness that identifies the critical differences for public organizations in being strategic. Central to their notion of publicness is the concept of political authority and the influence of political authority on all organizational behaviors. This influence is seen in the constraints placed on public organizations and public management. Included here are external variables such as policy creation and enactment, the posturing and agenda-setting activities of elected and appointed officials, and the constitutional basis of governance which engenders a range of citizen responses to public activities. Byproducts of the presence of political authority include a short time frame for strategy development and implementation, innate ambiguities in the ability to measure performance of public organizations, and the particular effect of the annual budget processes as a rein on any long-range program orientation.

Kaplan (2000) argues that a major barrier to public management and to strategic planning is that government is not conditioned to see the value in having a strategy. While organizations in the private sector have long accepted the wisdom of being strategic, strategy is more often akin to being viewed as a luxury by public managers. There is little incentive to plan ahead to meet some long-range goals as government operates on a short-term timeframe, constrained by both the budget and the electoral process. Mission or strategic goals for government also tend to be overarching, with no one agency being able to take responsibility for such targets. Many missions require integration of services among agencies, for example, eliminating hunger or homelessness, yet government is structured and funded by agency. There are no incentives or rewards to cooperate on programs. Further, the federal budget does not encourage such activities, as funding is parceled out by agency and not by program or mission. Kaplan also notes that governments are risk-averse organizations at heart and the notion of doing anything strategic that may stretch their boundaries is not congruent with their culture. This does not mean that government cannot be strategic—just that it has a difficult time with the whole notion of strategy.

Gabris (1992) notes that the process of public-sector strategic planning is "akin to pulling teeth" (p.79), often as a result of the constraints from political authority. He argues, however, that important benefits can occur by engaging in the strategic planning process. Public sector organizations involved in the development of a strategic plan gain perspective on their goals and on the specific activities needed to meet these goals. Gabris further notes that engaging in the strategic planning process itself is beneficial to public organizations, complementing and facilitating a cooperative decision-making process. At the macro level of an organization, a strategic planning process that is participative in nature offers a context for and content to the mercurial and political aspects of public management (Golembiewski & Gabris, 1995).

The effects of strategic planning go beyond the creation of a cooperative environment for policy makers and implementers. The strategic planning process, as a formative activity, can generate a sense of enthusiasm and dedication when management staff are active participants in the venture. This can be an incentive to action for those who implement policy in government agencies. The very nature of public organizations makes the provision of incentives often daunting. These organizations are constrained and cannot offer monetary compensation, travel perks, autonomy and flexibility in work life, and other clear rewards for achieving equally clear performance goals. Thus, co-opting public managers into the strategy process can serve to get their commitment to the mission (Nutt & Backoff, 1993). It can be seen that there are secondary gains to be accrued from the strategy process in public organizations, and organizations should avail themselves of these advantages. But, an important bottom line here is that the constraints of political authority cannot be ignored. Any strategic planning process must be aware of these or it will be doomed to fail.

Strategy and Information Resources

The development of a formal and considered approach to an organization's information resources goes hand-in-hand with the strategic planning process. Information resources are no longer viewed as an afterthought to the planning process. The coordination of IT with the strategic business plan helps to create an environment where the IT capability of an organization will be appropriate to the mission and business goals (Tapscott & Caston, 1993). Strategic planning for IRM is equally important in government as it is in the business world. The Center for Technology in Government (2002) offers five factors that contribute to a strategic mindset in managing and maximizing information resources in government. They include:

- Understanding the business need;
- Knowing the needs of the stakeholders;
- Taking into account the current and the past information resource environment in an agency;
- Looking ahead to the future; and
- Defining a clear, unambiguous approach.

These five factors emphasize the need to understand deeply who you are, who you serve or affect, your history, your intended future, and how to achieve it. Not an easy task! Yet, failure to take these factors into consideration can have very negative consequences, foremost being a failure to accomplish the agency's mission. And minimally, without attention to all of these factors, IT projects are not likely to be successful.

The strategic plan embodies the vision of where an organization wants to be; the information resources add value to achieving this vision, thus becoming a necessary resource to plan. The impact of IT on business and government in the past 40 years has been dramatic. Information technology has changed the rules of business and the boundaries of competition (Porter & Millar, 1985; Laware, 1991; Porter, 2002). In the creation of an organization's hierarchy of strategies to accomplish its mission, the IT plan is a critical layer that supports the overarching vision. It is also generally accepted today that to successfully manage information resources, they must be included as an integral component of any strategic plan (Ein-Dor & Segev, 1978).

Bozeman and Bretschneider (1986) envision the role of IT in public organizations as essential in anticipating external contingencies. They assert that planning for IT needs to be both comprehensive and forward looking in an effort to anticipate the influence and direction of public authority. Attention to political cycles and agendas, as well as to the statutory constraints in a public organization's environment can be facilitated by a strategic use of information resources.

Marchand and Kresslein (1988) contribute more arguments for the value of strategic IRM planning in public organizations. First, they assert "that government is a large multiproduct firm that processes information either as a direct product or as a necessary aspect of delivering its services to citizens" (p. 396). Their second contention is that government depends on its information resources to carry out its business. IT is a necessary and basic tool in government today, as are human capital and infrastructure. The decision to invest in, maintain, and upgrade IT is no longer an option; it is a fundamental and continuous process for an organization. Given this critical viewpoint of information resources, it makes sense that the development and implementation of a strategic IT plan is part of any successful business practice. Further, information resources represent a complex, large, and expensive investment; one which is high risk and fraught with uncertainty. These factors, by themselves, make a compelling case for strategic IRM planning.

Another GAO report (January 31, 1997) reflects some of the current environmental drivers for the strategic management and use of IT in government agencies. First, the climate of urgency that permeates government today creates a need for government leaders to be directly involved in designing and achieving the attainment of agency missions. As IT is pervasive in government today, it becomes a smart tool for enabling mission success if it is linked to planning goals. The second key driver has to do with the public perception of government services. Citizens today are used to a high level of service quality from the private sector, much of which has been created by the strategic use of information resources. Citizens expect and demand the same level of service from their government agencies. This elevates information management from the mundane to the strategic. A third factor is the current focus on performance and accountability for results. This makes visible the management and use of information resources in government agencies. It is not a hidden asset or an overhead cost, nor is it buried in budget line items as office supplies or equipment as in the past. The use and performance of IT in an accountable government is highly visible and tracked, as was the intent of GPRA (GAO June 19, 2001).

Strategy, information resources, and planning form an integrated triangle when they are explicitly managed. A case has been made for the importance of strategic thinking and planning in the use of information resources. These resources are a ubiquitous source of value to government today as IT and the Internet transform how government delivers information and services to citizens and business. Even if we did not have Congress mandating strategic government-wide IRM planning, a strong business case can be made for this management practice.

GOVERNMENT-WIDE STRATEGY UNDER THE PAPERWORK REDUCTION ACT

The need for strong IT leadership and a government-wide strategic view of information management has long been recognized as critical. Today the role of information management in creating value in government is well recognized (GAO, March 21, 2002). In 1976, with the establishment of the Commission on Federal Paperwork, Congress emphasized the need to develop information management policy for the federal government. The report from the Federal Paperwork Commission led to the Paperwork Reduction Act. The PRA established a single policy framework for federal management of information resources and formalized the institutionalization of IRM as the approach governing information activities. Additionally, the PRA created the Office of Information and Regulatory Affairs, a statutory office in the Executive Office of Management and Budget. OIRA, through its director, was charged to develop IRM policy and oversee its implementation, at the same time giving it oversight responsibilities in specific IRM functional areas including records management, information collection, privacy, security, access, and statistics. The OIRA director—appointed by the President—is also the principal adviser to the director of OMB on IRM policy. The Clinger-Cohen Act of 1996 amended the PRA to also give OIRA, through its administrator, significant leadership responsibilities in supporting the federal agencies' actions to improve their IT management practices. The strategic planning for all information resources to ensure accountability and effectiveness for information systems was a major focus of both acts (Fletcher, 2002).

Along with OIRA, two other government entities perform PRA-related activities. The first is the Chief Information Officers (CIO) Council, established by executive order 13011 in July 1996 as an interagency forum for improving agency IRM practices. The council has no authority or control over government-wide IRM. It is an advisory body, making recommendations for overall IT management policy, procedures, and standards. It is further charted "to provide advice to OMB on the development of the government-wide strategic plan."[3] The council is composed of the CIOs and deputy CIOs from 28 federal agencies, plus senior officials from OMB/OIRA. The CIO Council vision, as expressed in its charter (2/29/1997) is:

> *To be a resource which will help the Government to work better and cost less by promoting the efficient and effective use of agency information resources. The CIO Council supports business process reengineering, continuous process improvement, and measurable increases in employee productivity in the performance of work related to the achievement of agency objectives.*

Second, in June 2001, OMB established the position of associate director for information technology and e-government. The associate director is responsible for: (1) furthering the administration's goal of using Internet technologies to create a citizen-centric government; (2) ensuring that the federal government takes maximum advantage of IT and associated best practices to improve the quality, effectiveness, and efficiency of government information and services; and (3) leading the development and implementation of all federal IT policy. In addition, the associate director is responsible for overseeing implementation of IT throughout the federal government and directing the activities of the CIO Council. Given that OMB has cited the strategic plan of the CIO Council as *the* government-wide strategic plan required by the PRA, this alignment of OIRA, the assistant director for e-gov, and the CIO Council assume a critical importance.

OIRA's Planning Activities under the PRA

The Congress of the United States and an extensive history of research literature support the concept of strategic planning for information resources. As noted above, the PRA mandates that OIRA develop and maintain a strategic IRM plan that is government-wide in scope, setting the strategic direction for information technology for all executive agencies of the federal government. The act is specific in what the plan must cover, the scope of the plan, who should be involved in its development, and where the responsibility for the plan lies. These are not insignificant requirements, nor are they small tasks to accomplish. A major review of OIRA's responsibility for this plan was conducted in the fall of 2001, with disconcerting results. Given the importance of strategic planning and the number of years that OIRA has had to develop this plan, it is troubling that such a government-wide plan still does not exist. As noted above, since 1998, OIRA's response to this requirement has been to designate the strategic plan of the federal CIO Council as the government-wide strategic IRM plan. Council members and OIRA staff are involved in its development, and the plan is jointly published by the Council and OIRA. Unfortunately, these two conditions are not sufficient to meet the intent of the PRA.

It was not a goal of the review to comment on the quality of the CIO Council's strategic plan. Rather, the plan was examined for its relevance to the federal government as a whole, as well as its sufficiency under the PRA. The most current CIO Council plan, the *CIO Council Strategic Plan for Fiscal Years 2001-2002,* was the object of review. While a robust document for the council, this plan does not constitute an effective government-wide strategic IRM plan. The plan states in its introduction that

> *Since January 1998, OMB and the CIO Council have jointly published a strategic plan to meet the requirements of the Paperwork Reduction Act of 1995 and Executive Order 13011 on Federal Information Technology. The goal of the strategic plan is to enhance the strategic focus of the Council, establish roadmaps for achieving the strategic vision, define measures to assist the council in evaluating its progress toward meeting its challenges, and provide a basis for budget planning.*

It is clear from this introduction that while the council acknowledges the PRA in the plan's development, the document itself reflects that it is purely a plan for the CIO council and not a government-wide framework for the agencies. The major goal defined in the CIO plan is to enhance the strategic framework of the council, not federal government. While it may be assumed that the council is a surrogate for federal agencies, nowhere is this explicit. Thus, the council and all of its goals reflect the activities of this advisory body, not of federal agencies or the federal government as a whole.

Under the PRA, OIRA and its administrator are specifically charged to:

- Consult with the administrator of General Services, the director of the National Institute of Standards and Technology, the archivist of the United States, and the director of the Office of Personnel Management, to develop and maintain a government-wide strategic plan for IRM;
- Develop the objectives and means by which the federal government shall apply information resources to improve agency and program performance;
- Develop plans to reduce the information burden on the public, including the elimination of duplicate systems of information;
- Enhance public access to and dissemination of government information using electronic and other formats;

- Meet the IT needs of the federal government; and
- Describe the progress made in applying IRM principles to improve agency performance and accomplishment of missions.

When taking these specifics, one-by-one, and applying them to the CIO Council strategic plan, it is clear that this plan does not suffice. The required consultation with other agency directors is not evident in the plan or in the planning process. OIRA officials stated that while they do not directly ask these administrators for specific input to the plan, through various agency meetings and other guidance and review activities, the strategic viewpoint of these senior administrators was captured. They also noted that representatives of the PRA-required agencies currently sit on the council (although some in an *ex-officio* capacity) and thus participated in the development of the strategic plan.

Second, although the plan establishes many goals that are government-wide in nature, these goals are not linked to expected improvements in agency and program performance. For example, the plan contains a government-wide goal of interoperable and innovative IT initiatives; however, the plan does not discuss how these initiatives will improve agency performance, nor does it establish target objectives for improvement. Further, the plan's goals do not comprehensively address the IRM life cycle. Statistical activities, records management, and the collection and control of paperwork—a specific PRA activity required to be in the plan—are not addressed at any point in this document. All of these are required information management activities under the PRA, yet their strategic management receives no attention in the council's strategic plan.

When looking at the goals and strategies to achieve IRM, the plan again falls short. It does contain strategies for reaching the council's goals that, again, are not necessarily government-wide IRM goals. Further, their strategies are incomplete. Specifically, the plan does not address, even at a high level, OIRA's policy-making and oversight role in helping to attain government-wide IRM goals. Further, the plan does not discuss the resources needed government-wide —by OIRA, the CIO Council, and federal agencies—to achieve its goals.

The plan does not address the requirement to reduce the information burden on the public. While it includes goals and strategies that may ultimately result in burden reduction—such as creating interoperable and innovative government-wide initiatives—they are not linked to burden reduction. No direction is offered on eliminating redundant systems across government. Nor does the plan include a discussion of meeting shared data needs with shared resources, another way to reduce paperwork burden. Notably lacking in the plan is any description of progress already made in applying IRM principles to improving agency performance and mission accomplishment. Finally, the performance measures articulated in the plan are not geared toward providing the required information on government-wide progress in IRM. The measures focus solely on gauging the council's progress in meeting its goals, rather than on progress in improving agency and program performance.

The plan does addresses some but not all of the remaining items as required in the PRA. In specific, there is attention paid to:

- Enhancing public access to and dissemination of information. The council's first goal—connecting all citizens to the products, services, and information of their government—is focused on making government information accessible and facilitating transactions with citizens; and
- Meeting the IT needs of the government. Specifically, goal six focuses on IT investment management practices and tools to improve delivery of government services and programs. Strategies include improving the quality of data used to support investment decision making, information technology acquisition strategies, and IT performance measurement.

In discussing this evaluation of the CIO Council strategic plan, OMB officials responded that while the CIO Council plan is OIRA's primary means of complying with the strategic planning requirements under PRA, OMB produces a range of other documents that also contain elements of a government-wide plan. They noted that there is not, per se, one government-wide strategic plan. Rather, it is a collection of documents, as a whole, that constitutes the government-wide strategic IRM plan under PRA. According to OMB, these additional documents are as follows:

- Annual independent evaluations of agency security programs required under GISRA;
- *The Budget of the United States Government*;
- Agency reports on progress in implementing the Government Paperwork Elimination Act;
- The annual Information Collection Budget prepared by OMB;
- The strategic plan of the National Archives and Records Administration; and
- *The President's Management Agenda*.

This disparate and uncataloged list of documents—whether viewed individually or in total—doesn't address the weaknesses identified. Of these documents, only one stands out as government-wide and strategic—the *President's Management Agenda,* which articulates the goal of expanding e-government in the federal arena as well as strategies for accomplishing that goal. Although this agenda adds additional perspective on the administration's strategic direction for certain aspects of IRM, it is not broad enough to compensate for the weaknesses in the CIO Council plan. In examining the other documents on this list it is obvious that they do not suffice. The current NARA strategic plan for fiscal years 1997-2007 includes no government-wide goals or strategies for records management. It is a representation of NARA's articulated goals and strategies and has a focus on the agency mission, not on government-wide IRM. The remaining documents deal with various aspects of the government's current or past use of information resources or are one-year projections of approved activities. But they are neither strategic nor focused on the future, nor do they claim to be.

Further, this plethora of diversely issued and located documents are neither integrated nor formalized as a government-wide strategic plan. It would be all but impossible to paste this list together should agencies, the Congress, or other stakeholders want to view the plan in its totality. As a result, these documents do not clearly communicate the strategic IRM vision of the government. There are too many shortcomings in OIRA's response to the PRA that ultimately indicate that they have not devoted sufficient attention to producing an effective government-wide strategic IRM plan. Consequently, the federal agencies are left to address information needs in isolation without a comprehensive vision to unify their efforts. Further, the risk is increased that investments in IT will not be leveraged across the government; that duplicative initiatives will be undertaken; that opportunities for data sharing and public access will be missed; that privacy will be compromised; and that the security of information, information systems, and critical infrastructure will be jeopardized. Without the requisite strategic leadership from OIRA and the application of appropriate resources to ensure the development of a comprehensive and meaningful plan, the mounting challenges that the government faces in managing its information resources may not be met.

CONCLUSIONS

Government is clearly not exempt from economic, political, and social pressures, which become even more complex in a global networked information environment. The government has a customer base that is becoming more sophisticated and demanding, as customers become accustomed to the benefits of an Internet-enabled world. The extensive adoption of Internet technology, coupled with the constant and rapid advances in IT, create an environment with constantly changing business rules. Government is also constrained by other aspects of publicness. Congress holds the purse strings along with creating the legal framework for agency missions and activities. The elected officials encourage a short-term approach to managing government, conducive to their terms of office, but not to the creation of any strategic vision.

A review of the strategic planning activities under the PRA clearly indicates that there is no one government-wide strategic IRM plan. Given the statutory requirement to have such a plan, the ubiquity of information technology, the high cost and risk associated with major IT systems, and the federal government's role as the largest producer of information in the world, it is curious that there is no government-wide plan to manage these resources. Current and emerging challenges—including the events of September 11—emphasize the importance of a strategic and integrated approach to managing information resources. Given the magnitude of external changes that have occurred since the CIO Council plan was published in October 2000, OIRA has a tremendous opportunity now to exercise its IRM leadership (GAO, May 21, 2002). OIRA can take the lead to develop a unified government-wide plan which would communicate a clear and comprehensive vision for how the federal government will use information resources to improve agency performance, be responsive to the current external environment, including the integral role of information in the security of our country, and plan for the human capital needed to achieve government-wide IRM goals. OIRA can also use this as an opportunity to engage in consultation with all stakeholders—including the Office of Homeland Security, entities involved in information security and critical infrastructure protection, and the officials identified in the act—who are critical to meeting IRM challenges and the goals the administration has established in its management agenda. Further, OIRA can make use of best practices in strategic planning, including the use of the dimensions of strategic planning presented in this chapter. A clear articulation of a limited set of core strategic goals, a comprehensive evaluation of the critical resources needed to accomplish the strategic goals, coupled with attention to the constraints imposed by the policy environment can create a useful framework for government-wide strategic planning.

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ENDNOTES

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[2] While by no means a complete list of relevant legislation, the laws guiding the activities referred to in this chapter include the Government Performance and Results Act of 1993, the Clinger-Cohen Act of 1996, the Privacy Act of 1974, the Computer Security Act of 1987, the Government Information Security Reform provision of the 2001 Defense Act, the Government Paperwork Elimination Act of 1998, the Federal Records Act of 1950, the U.S. Code of Federal Regulations 1228.1-1228.231, the Freedom of Information Act of 1966 and the Electronic Freedom of Information Act Amendments of 1996, and Executive Order 13011 Federal Information Technology. Principal guidance includes OMB's Information Quality Guidelines to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information, including statistical information, disseminated by Federal agencies, and OMB Circular A-130 Management of Federal Information. There are also other associated Executive Orders and OMB memoranda and circulars relevant to the implementation of these acts.

Chapter V

Mediating the Tension Between Information Privacy and Information Access: The Role of Digital Government

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ABSTRACT

Government agencies collect and disseminate data that bear on the most important issues of public interest. Advances in information technology, particularly the Internet, have multiplied the tension between demands for evermore comprehensive databases and demands for the shelter of privacy. In mediating between these two conflicting demands, agencies must address a host of difficult problems. These include providing access to information while protecting confidentiality, coping with health information databases, and ensuring consistency with international standards. The policies of agencies are determined by what is right for them to do, what works for them, and what they are required to do by law. They must interpret and respect the ethical imperatives of democratic

accountability, constitutional empowerment, and individual autonomy. They must keep pace with technological developments by developing effective measures for making information available to a broad range of users. They must both abide by the mandates of legislation and participate in the process of developing new legislation that is responsive to changes that affect their domain. In managing confidentiality and data access functions, agencies have two basic tools: techniques for disclosure limitation through restricted data and administrative procedures through restricted access. The technical procedures for disclosure limitation involve a range of mathematical and statistical tools. The administrative procedures can be implemented through a variety of institutional mechanisms, ranging from privacy advocates, through internal privacy review boards, to a data and access protection commission.

THE TENSION BETWEEN PRIVATE LIVES AND PUBLIC POLICIES

An Environmental Scan

In its normal activities, the public sector captures enormous amounts of data, stores it in very large databases, analyzes some of it, and disseminates information products to individuals, governments, businesses, and other organizations. Much of these data are obtained directly from respondents in surveys and censuses or through building systems of administrative records based on a variety of citizen interactions with government. Surveys include:

- Face-to-face interviews, as with the National Longitudinal Surveys of Young Women conducted by the Bureau of Labor Statistics;
- Telephone surveys, as with the Behavioral Risk Factor Surveillance System conducted by the Centers for Disease Control and Prevention, which estimates current cigarette smoking and use of smokeless tobacco; and
- Mail-back responses (including electronic mail), as with the reactions to their website obtained by Inland Revenue of the Government of New Zealand (see www.ird.govt.nz/survey.htm).

Administrative records include:

- Employer-furnished data, as with Social Security Administration earnings records;

- Licensing data, as with state Departments of Motor Vehicles and local building permits; and
- Individual and firm submitted data, as with Internal Revenue Service tax returns.

The Internet has accelerated the demand for access to government information services, primarily by broadening the range of potential data users. Access demand is in commensurate tension to concerns about privacy and confidentiality. The National Science Foundation in its Digital Government program announcement (NSF, 1999), affirms, "Given the inexorable progress toward faster computer microprocessors, greater network bandwidth, and expanded storage and computing power at the desktop, citizens will expect a government that responds quickly and accurately while ensuring privacy." This article focuses on ways the public sector can resolve the growing tension between the demand for government data and concerns for privacy protection.

Government databases are rich in information and have evident practical utility for planning, marketing, and research. Still, many would-be users complain they cannot obtain the data they need, often thwarted by confidentiality concerns (Smith, 1991). On the other hand, privacy advocates warn of the dangers of unfettered data capture and dissemination. Their arguments are ethically based. "Individuals in the Western world are increasingly subject to surveillance through the use of data bases in the public and private sectors, and these developments have negative implications for the quality of life in our societies and for the protection of human rights" (Flaherty, 1989, 1). From a more utilitarian standpoint, public policy would be affected by declining survey participation rates. In 1992, for example, 31 percent of Americans refused to answer at least one survey, compared with 15 percent in 1982 (Leftwich, 1993; also see Dalenius, 1993). Acrimonious public debates rage about proper use of mailing lists, credit records, medical histories, and Social Security numbers (Flaherty, 1989). The media highlights privacy concerns in the use of ever-larger computer databases—those of terabyte size, labeled "data warehouses."

Broad access to data supports democratic decision making. Access to government statistical information supports public policy formulation in areas ranging through demographics, crime, business regulation and development, education, national defense, energy, environment, health, natural resources, safety, and transportation. Thrust against the evident value of data access is the counter value that private lives are requisite for a free society. This article deals with an important aspect of the tension between information privacy and data access—the proper handling of personal information that is collected by government. Other privacy issues such as video surveillance, telephone interception or 'bugging,' Internet censorship, protecting children, encryption policy, and physical intrusion into private spaces are outside our purview.

A variety of governmental agencies have important roles in collecting, storing, analyzing, and disseminating information. Certainly this is the case with the federal statistical agencies, such as the US Census Bureau, National Center for Health Statistics, and the Bureau of Labor Statistics. But it is also true of state public health organizations and functional agencies such as departments of motor vehicles. Each agency is tasked with the dual responsibilities of protecting privacy and confidentiality while disseminating information to client users, often including the general public (Duncan & Pearson, 1991; Duncan, Jabine, & de Wolf, 1993).

The Internet is becoming the richest source for data collected by government agencies and academic researchers. The following is a very short list of government websites, compiled to illustrate the ever-widening variety.

US Census Bureau (factfinder.census.gov): The American FactFinder website allows the construction of detailed tables of age, sex, race, etc., for geographic areas as small as a block group. Hundreds of thousands of ready-made tables, indexed by data source, geography and other characteristics are available.

National Center for Educational Statistics (www.nced.ed.gov/pubsearch): Data files, such as the Local Education Agency (School District) Universe Dropout Data, are available for download in a variety of machine-readable formats. NCES also offers data licenses giving authorized researchers access to more than a dozen restricted-use data products such as the National Educational Longitudinal Survey.

California Dept. of Corrections (www.cdc.state.ca.us/issues/capital/capital9.htm): A list of all prisoners on death row.

Arizona Secretary of State (www.sos.state.az.us/Business_Services/UCC_full_Index.htm): Searches and listings of liens, associated filings, debtors and secured parties.

Inter-University Consortium for Political and Social Research (www.icpsr.umich.edu/): Hundreds of data files from government-funded surveys on topics such as natality, drug abuse treatment, and the American Housing Survey.

What are some contentious issues in the clash between demands for information privacy and data access? To address this question we can examine some of the bills submitted in the US Congress. For all bills the basic source is the Library of Congress site www.thomas.loc.gov. Targeted to pending legislation regarding the issues of information privacy and information access are sites maintained by:

- Electronic Privacy Information Center (EPIC) at epic.org/privacy
- Center for Democracy and Technology (CDT) at www.cdt.org
- Association for Interactive Marketing (AIM) at capwiz.com/aim

The key issues addressed in legislation introduced to the 107th Congress (2001-2002) include

- restricting access to database information to those with a need to know
- opt-in vs. opt-out policies
- dealing with so-called universal identifiers, especially the Social Security number
- establishing health information databases
- financial information privacy
- protection against terrorism, identification cards

In the next section we examine legislation that is already on the books that both attempts to protect government data and constrains its use by agencies.

Relevant Legislation

Some agencies are guided by specific legislation. The US Census Bureau, for example, is governed by Title 13 of the US Code, which provides for tight controls on individually identifiable data. In particular, Section 9 provides that

> (a) Neither the Secretary, nor any other officer or employee of the Department of Commerce or bureau or agency thereof, or local government census liaison, may, except as provided in Section 8 or 16 or Chapter 10 of this title - (1) use the information furnished under the provisions of this title for any purpose other than the statistical purposes for which it is supplied; or (2) make any publication whereby the data furnished by any particular establishment or individual under this title can be identified; or (3) permit anyone other than the sworn officers and employees of the Department or bureau or agency thereof to examine the individual reports. No department, bureau, agency, officer, or employee of the Government, except the Secretary in carrying out the purposes of this title, shall require, for any reason, copies of census reports which have been retained by any such

> establishment or individual. Copies of census reports which have been so retained shall be immune from legal process, and shall not, without the consent of the individual or establishment concerned, be admitted as evidence or used for any purpose in any action, suit, or other judicial or administrative proceeding.

Similarly for the Internal Revenue Service, Section 6108(c) of the US Internal Revenue Code of 1986 stipulates that

> No publication or other disclosure of statistics or other information required or authorized by subsection (a) or special statistical study authorized by subsection (b) shall in any manner permit the statistics, study, or any information so published, furnished, or otherwise disclosed to be associated with, or otherwise identify, directly or indirectly, a particular taxpayer.

The US Social Security Administration enjoys comparable legislative protection of its data through Section 1106 of the Social Security Act.

On the other hand, the Bureau of Labor Statistics has no specific statutory protection to preserve the confidentiality of identifiable information. Instead, the bureau's confidentiality policy is established by Commissioner's Order 3-93, *Confidential Nature of BLS Records*, which in Section 7(a) states that data "collected or maintained by, or under the auspices of, BLS under a pledge of confidentiality shall be treated in a manner that will ensure that individually identifiable data will be used only for statistical purposes and will be accessible only to authorized persons" (see de Wolf, 1995 for discussion of BLS confidentiality policy).

Chapter 5 of Duncan, Jabine, and de Wolf (1993) presents a comprehensive view of the legislative environment of federal statistical agencies. Under current legislation, the degree of data protection depends on the agency that holds it without regard to the sensitivity of the information. Also, data sharing among agencies is difficult because agencies with a high degree of legislative protection of their data are reluctant to share with those with a low degree of protection. For example, the National Agricultural Statistics Service (NASS) has had a complicated relationship involving the sharing of lists of farms for the Census of Agriculture, which is conducted every five years. The Census of Agriculture was officially moved from the Census Bureau to NASS on December 31, 1997. In conducting the 1997 Agriculture Census, the Census Bureaus provided NASS employees (many of whom were Census Bureau employees) with farm list information. To do this they were made Census special sworn employees. Restricted access is provided through the Census Bureau's Bowie computer center to NASS headquarters and the regional centers. In 1992, the Census Bureau swore in a limited number of NASS employees to see data collected under the auspices of Title 13, but they were required to come to the Census Bureau's headquarters in Suitland, Maryland to see the data. The official transfer of the program was delayed until the end the 1997 so that the Census Bureau would continue to have the authority to get IRS tax return data to construct the list. (NASS had no such authority.) Beginning in 2002, NASS will have to work with IRS to get access by amending the tax code or through proposed data sharing legislation if it becomes law.

In addition to this legislation, there are variety of other relevant laws and regulations at the federal level. They include, but are not limited to: Computer Security Act of 1987 (www.epic.org/crypto/csa/, Copyright Act of 1976 (www.law.cornell.edu/copyright/copyright.table.html), National Archives and Records Administration Regulations, Freedom of Information Act (www.aclu.org/library/foia.html), Information Technology Management Reform Act of 1996 (www.itpolicy.gsa.gov/mke/capplan/cohen.htm), Paperwork Reduction Act of 1995 (www.law.vill.edu/chron/articles/ombdon.htm), and the Privacy Act (www.eff.org/pub/Legislation/privacy_act_74_5usc_s552a.law). Discussion of each of these can be found on the web at the indicated URLs.

WHAT PRINCIPLES SHOULD GUIDE DATA STEWARDSHIP?

The principles set forth here for data stewardship derive from Duncan, Jabine, and de Wolf (1993). The United States and a growing list of other countries embrace a freedom that recognizes pluralism, public decision making based on representative democracy, and a market-oriented economy. Consistent with this ethos an ethics of information can be built on three principles: democratic accountability, constitutional empowerment, and individual autonomy. These principles can provide a useful guide for assessing the societal impacts of information policies of any organization, whether in the public sector or not. They have particular interpretations for government agencies that are explored later in this chapter.

Democratic accountability is the assurance through institutional mechanisms, culture, and practice that the public obtains comprehensive information on the effectiveness of government policies. Prewitt (1985) explored this concept. The technology of the Web is the most exciting implement for fostering democratic accountability. A quick click to the Social Security Administration's website at www.ssa.gov yields SSA's Accountability Report for FY 1997. It provides full disclosure of SSA's financial and programmatic operations. This Web presentation gave the agency the right to assert, "With its publication on November 21, 1997—less than two months after the close of the fiscal year—SSA became the first Federal agency to publish its FY 1997 Accountability Report. FY 1997 marks the eleventh year that SSA has published audited financial statements, the fourth year that SSA has received an unqualified opinion on its financial statements and the third year that SSA has been authorized by the Office of Management and Budget to streamline and consolidate statutorily required financial reporting into a single Accountability Report."

Constitutional empowerment is the capability of citizens to make informed decisions about political, economic, and social questions. Constitutional practice emphasizes restraints on executive excess and broad access to the political process through the direct election of representatives, as well as through separation and balance of power. Many government agencies have seized upon the Web as a vehicle for providing information broadly to the citizenry. A prominent development in this regard is the plan announced on June 25, 1998, by Bruce A. Lehman, commissioner of patents and trademarks, to create the largest government database on the Internet. More than two million patents will be searchable by keyword. Including trademark information the database will comprise more than 21 million documents and require 1.3 terabytes of storage.

Individual autonomy is the capacity of the individual to function in society as an individual, uncoerced and cloaked by privacy. Individual autonomy is compromised by the excessive surveillance sometimes used to build databases (Flaherty 1989), unwitting dispersion of data, and a willingness by those who collect data for administrative purposes to make them available in personally identifiable form. Government agencies have both ethical and pragmatic reasons to be concerned about individual autonomy. Ethically, agencies ought to respect individual dignity and protect the personal information entrusted to them. Pragmatically, without attention to individual autonomy agencies will find it difficult to enlist the voluntary cooperation that smooths operations.

THE SPECIAL ROLES OF GOVERNMENT AGENCIES: FUNCTIONAL SEPARATION

In implementing the three fundamental principles of democratic accountability, constitutional empowerment, and individual autonomy, a government agency should affirm a policy of *functional separation*. This policy makes a distinction between administrative data and statistical data. The distinction is on the basis of use:

- administrative data are used so that data on an individual has a direct impact on that individual
- statistical data are used to create aggregate measures that have an impact on individuals only through substantial group membership

Thus Joe Brown's liquor license application is initially part of administrative data since it is used to determine whether to issue Joe a license. When a database of such applications is used to determine whether females are issued liquor licenses as frequently as males, this constitutes a statistical use. Conceivably, such a study might affect administrative practice about license issuance in which case it might affect the chances of Joe Brown's subsequent application. This impact is due solely to Joe being male and is not determined by his particular data.

Agencies accept responsibility for protecting privacy and confidentiality for several ethical and pragmatic reasons. First, it is the right thing to do. Generally accepted ethical standards in the profession of data collection require attention to privacy and confidentiality (International Statistical Institute 1986, American Statistical Association 1989). Second, they get better data this way. Professionals believe that confidentiality pledges lower nonresponse rates and improve the quality of responses (Singer, 1993). Third, the law requires it. Privacy and confidentiality protection is often mandated by legislation or regulation (Duncan, Jabine, & de Wolf, 1993).

The Privacy Protection Study Commission (1977, 574) proposed,

> That the Congress provide by statute that no record or information contained therein collected for a research or statistical purpose under Federal authority or with Federal funds may be used in individually identifiable form to make any decision or take any action directly affecting the individual to whom the record pertains, except within the context of the research plan or protocol, or with the specific authorization of the individual.

The National Research Council sponsored the Panel on Confidentiality and Data Access. In its report, *Private Lives and Public Policies*, the panel made the following recommendation (Duncan, Jabine, & de Wolf, 1993: Recommendation 5.1, p. 134):

> Statistical records across all federal agencies should be governed by a consistent set of statutes and regulations meeting standards for the maintenance of such records, including the following features of fair statistical information practices:
> (a) a definition of statistical data that incorporates the principle of functional separation as defined by the Privacy Protection Study Commission,
> (b) a guarantee of confidentiality for the data,
> (c) a requirement of informed consent or informed choice when participation in a survey is voluntary,
> (d) a requirement of strict control on data dissemination,
> (e) a requirement to follow careful rules on disclosure limitation,
> (f) a provision that permits data sharing for statistical purposes under controlled conditions, and
> (g) legal sanctions for those who violate confidentiality requirements.

This recommendation refers to federal agencies. The issues are similar for state agencies and for countries other than the United States. We would, therefore, maintain that these fair information practices are broadly applicable to government operations.

PRIVACY LEGISLATION IN THE EUROPEAN UNION

The discussion above illustrates the distinction in the US between legislation and policies applicable to government agencies and laws restricting the data activities of private entities such as insurers and marketers. A different model is provided by the European Union. Information about Directive 95/46/EC (1995) of the European Parliament is available at www.cdt.org/privacy/eudirective.

This EU directive became effective in October 1998. It specifies policies for the protection of individuals that must be adhered to by all members of the EU. These policies apply uniformly to both the public and private sectors. Each member country is permitted to have stricter rules governing data related to their own residents; the EU directive provides a minimal set of protections across all members and is designed to foster consumer confidence and encourage e-commerce. The directive also establishes rules to ensure that personal data is only transferred to countries outside the EU when its continued protection is guaranteed.

Looking first at the rules governing movement of personal data, the directive delineates the kinds of data affected. In language similar to the US Privacy Act, data processing is covered only if it is "automated or if the data processed are contained or are intended to be contained in a filing system structured according to specific criteria relating to individuals, so as to permit easy access to the personal data in question;" private correspondence and personal address books are excluded, for example. Further exemptions include data necessary for public safety, defense, state security and "activities of the State in the area of criminal laws."

Data subjects must be informed of the data collected and the processing that will take place; further, subjects are guaranteed access to their data and have the right to request corrections. Again, this is similar to that of the US Privacy Act. However, an additional consideration is that subjects may "object to processing in certain [unspecified] circumstances.

The issues of de-identification and data linkage (discussed later in this chapter) are also considered in the EU directive. The rules are essentially these: Data that have been de-identified ("rendered anonymous in such a way that the data subject is no longer identifiable") are explicitly *not* covered by the directive. However, in determining whether or not de-identification has in fact occurred, the owner of the data must take into account "all the means likely reasonably to be used" to identify the data subject.

Paragraph (34) of the EU directive also deals with one area of medical records privacy:

> (34) Whereas Member States must also be authorized, when justified by grounds of important public interest, to derogate from the prohibition on processing sensitive categories of data where important reasons of public interest so justify in areas such as public health and social protection—especially in order to ensure the quality and cost-effectiveness of the procedures used for settling claims for benefits and services in the health insurance system—scientific research and government statistics; whereas it is incumbent on them, however, to provide specific and suitable safeguards so as to protect the fundamental rights and the privacy of individuals.

Here, and in other places, the directive allows member states to derogate from the general plan, provided explicit safeguards are in place.

Formally, the EU's Directive on Data Protection prohibits the transfer of personal data to non-EU nations unless protections in the receiving country are at least as strong as those provided by the directive. This poses a difficult barrier for US firms conducting business with EU member-states, since, as mentioned above, most US privacy legislation is not directed toward business. The self-regulated rather then legislated status of privacy policy in the private sector resulted in the "safe harbor" framework devised by the US Department of Commerce and the European Commission. Under the safe harbor rules, US firms can be certified to conduct data transactions with EU nations by pledging to provide adequate privacy protection (see www.export.gov/safeharbor).

The safe harbor framework insists on seven privacy principles:

- Notice: Individuals must be notified about the collection and use of their personal data.
- Choice: Individuals have the opportunity to refuse to allow sensitive data about them to be transferred.
- Outward Transfer: A certified organization must ensure that data transfers to a third party must also adhere to safe harbor principles.
- Access: Individuals must have access to data about themselves and must be given the opportunity to correct inaccurate information.
- Security: Reasonable precautions must be taken to protect personal data from unauthorized access, loss, or misuse.
- Data Integrity: Personal data must be used for the purpose intended and must be accurate, current, and complete.
- Enforcement: There must be means to ensure compliance, including individual recourse, verification procedures, and clear sanctions and penalties.

The safe harbor framework has not been widely embraced by US firms. In June 2002, more than a year and a half after its adoption, only about 200 US companies had been certified.

PROBLEMS AND OPPORTUNITIES IN ENSURING CONFIDENTIALITY AND DATA ACCESS

The public sector faces a variety of predicaments as well as opportunities as it seeks to fulfill its responsibilities for both confidentiality and access to data. The problems and possibilities are accentuated by economic and cultural changes, and importantly by developments in information technology. This section will examine these factors as they affect the various stakeholders in the process—the data subjects, the data users, and the agencies that have stewardship of the data.

Data Subjects

Government agencies depend on individuals, firms, and organizations to provide data that accurately reflect some of the most personal and sensitive aspects of their lives and operations. Some of this data provision is mandated by legislation, as public corporations are required to provide the Securities and Exchange Commission with filing information and individuals must file an income tax return with the Internal Revenue Service. Other data provision is voluntary, as when the Substance Abuse and Mental Health Services Administration interviews people at their residence about use of licit and illicit drugs.

Anecdotal evidence suggests that response rates of federally funded demographic surveys have been declining. To address this issue, the Federal Committee on Statistical Methodology formed a Subcommittee on Nonresponse that collected information on 26 federally-sponsored demographic surveys. Response and refusal rates remained relatively constant but noncontacts fluctuated over the 10-year period 1982-1991. They found a "core" proportion of the population that routinely refuses to participate in federally sponsored surveys.

The key ethical concepts related to data subjects are informed consent and notification. Informed consent is appropriate for truly voluntary surveys, while notification applies otherwise to data collection that is mandatory, such as the Decennial Census, or where benefits hinge on providing information, such as applications for welfare benefits. The Privacy Act requires that each person asked to supply information be informed of (1) the authority under which the information is requested; (2) the principal uses for the information; (3) the "routine uses" that may be made of the information; and (4) the implications, if any, of not providing the information. The National Research Council's Panel on Confidentiality and Data Access (Duncan, Jabine & de Wolf, 1993) made recommendations for strengthening these stipulations. Noteworthy among these are requirements that data providers be notified of (1) nonstatistical uses of their data; (2) any anticipated record linkages for statistical purposes; and (3) the length of time the information will be retained in identifiable form.

Data Users

Data users span a diverse range of individuals and organizations. They include academic researchers at Cambridge University, policy analysts for the American Association for Retired Persons and the National Association of Home Builders, business economists for Wells Fargo bank, and statisticians for the Health Care Financing Administration. They include reporters for the *Toronto Star*, marketing analysts for L. L. Bean, advocates for the National Abortion Rights League, and medical insurance underwriters for Cigna. In general, data users employ the data they obtain for end uses such as policy analysis, commercial and academic research, advocacy, and education. They may also use data for various intermediate purposes, such as the development of sampling frames for surveys and the evaluation of the quality of other data.

From a government agency's viewpoint, the primary concern of data users is obtaining access to data. Users desire data that are relevant, accurate, and complete. They also want a usable data format, easy accessibility (low price, little hassle, quick response), timeliness (automatic updates and corrections), and few limitations on use. All of these concerns are legitimate, and they are uncontroversial except for the last, which can raise serious confidentiality concerns.

Often unanticipated are data users who force access through legal action, often as part of a discovery process and involving a court-issued subpoena. As Duncan, Jabine, and de Wolf (1993) note, many statistical agencies lack adequate legal authority to protect identifiable statistical records from mandatory disclosures for nonstatistical uses. An example of this was the ruling that Environmental Protection Agency could not protect company survey responses from the Department of Justice's Antitrust Division for use in compliance activities.

Many data users want to further disseminate the data to other users. This secondary data provision occurs in a variety of contexts: A government agency sponsoring a survey may share the information with another agency. A motor vehicle service may pass on licensed driver information to insurance companies for a fee. This data sharing requires careful managing of the advantages of more efficient data collection against the risks of confidentiality loss. Some laws governing confidentiality of data prohibit or severely limit interagency sharing of data, even for solely statistical purposes.

Organizations Representing Stakeholder Interests

A number of organizations represent various configurations of the stakeholder interests described above.

- **Association of Public Data Users** (APDU; see www.apdu.org/) assists users in the identification and application of public data; establishes linkages between data producers and users; and brings the perspectives and concerns of public data users to issues of government information and statistical policy.
- **Council of Professional Associations on Federal Statistics** (COPAFS; see members.aol.com/copafs/) represents academic/professional organizations interested in the production of federal statistical and research data. Member organizations include professional associations, businesses,

research institutes, and others interested in Federal statistics. COPAFS seeks to
  - Increase the level and scope of knowledge about developments affecting federal statistics
  - Encourage discussion within member organizations to respond to important issues in federal statistics
  - Bring the views of professional associations to bear on decisions affecting federal statistical programs.
- **Council for Marketing and Opinion Research** (CMOR; see www.cmor.org/) is a nonprofit trade association formed to protect the interests of the marketing and opinion research industry. It encourages respondent cooperation and lobbies lawmakers to protect research from restrictive legislation.
- **American Civil Liberties Union** (ACLU; see www.aclu.org/) affirms both privacy rights and the public's right to know.
- **Computer Professionals for Social Responsibility** (CPSR; see www.cpsr.org) is a public-interest alliance of computer scientists and others concerned about the impact of computer technology on society.

Such organizations provide consequential input to government agencies in dealing with privacy and information issues.

MANAGING CONFIDENTIALITY AND DATA ACCESS FUNCTIONS

General Issues

Wide-ranging mechanisms exist to deal with conflicts about the capture and dissemination of data. They span federal legislation, interorganizational contractual arrangements, intraorganizational administrative policies, and ethical codes. They also include technological remedies such as the release of masked data that may satisfy data users' needs for statistical information while posing little risk of disclosure of personal information (Duncan & Pearson, 1991). In managing confidentiality and data access functions, government agencies have two basic tools for responsible provision of information: restricted data and restricted access. As developed in Duncan, Jabine, and de Wolf (1993) these concepts have the following interpretations:

- **Restricted data.** Data are transformed to lower disclosure risk. This is accomplished through disclosure limitation techniques such as (1) release of only a sample of the data; (2) including simulated data; (3) "blurring" of the data by grouping or adding random error; (4) excluding certain attributes; and (5) swapping data by exchanging the values of certain variables between data subjects.

- **Restricted access.** Administrative procedures imposing conditions on access to data. These conditions may depend on the type of data user; conditions may be different for interagency data sharing than for external data users. An example of an institutional arrangement for restricted access by external data users is the Census Research Data Center at Carnegie Mellon University (see www.heinz.cmu.edu/census/).

Various restricted access policies (Jabine 1993a, b) have been implemented in the last twenty years. Notable have been the fellowship programs run jointly by the American Statistical Association and the National Science Foundation together with four agencies, the Bureau of Labor Statistics, the Bureau of the Census, the US Department of Agriculture, and the National Institute of Standards and Technology. The fellowship programs require that specific research projects and their data need be evaluated. If approved, data users relocate to the agency to gain access to unrestricted data. In some cases of restricted access, for example, to the Panel Study of Income Dynamics and the National Longitudinal Survey of Youth (Jabine, 1993b), the researcher must post bond. The money will be forfeited if the researcher fails to honor the release agreement, say by unauthorized sharing of the data or performing analyses not specified in the proposal.

The Bureau of the Census has long sought a mechanism by which it could make detailed census information more readily available to researchers, as well as connect census data to other important national datasets, such as those housed at the Environmental Protection Agency and the Department of Justice, while maintaining the integrity and confidentiality of that data. With this in mind, the Bureau recently established a number of Census Centers housed at universities across the country. Through access to such valuable data, these centers have attracted nationally renowned scholars to engage in inter-disciplinary, collaborative research on important policy issues.

Data Linkage

As more detailed personal data become available, from an ever-widening collection of sources, the danger increases that innocuous individual data sets may be combined to reveal sensitive information. The merging of data sets over common attributes is called data linkage. Through data linkage, even a data set that has been "de-identified" by removing identifiers such as name, address, Social Security number, and other unique attributes, may still pose a risk for disclosure. Consider the simple case of two files, the first containing such identifiers but no sensitive information, and a second file, containing some sensitive data, but consisting only of de-identified records. If the two files have non-sensitive attributes in common, it may be possible to find records that have unique and equal values for the overlapping attributes. A pair of such records links the identifying information in one file to the sensitive information in the other.

Readily available software and a desktop computer make it quite easy for a computer-literate individual to attempt data linkage. Methods originally developed to purge mailing lists of duplicate entries, where true duplicates may be slightly different because of typographical error, have been improved and extended to provide probabilistic estimates of matching. Precisely because these methods can be effective in the face of even substantial error in the data, they make the task of masking data to protect sensitive information more difficult.

A number of studies have shown that modern techniques for data linkage can be remarkably effective even in the presence of some types of data masking (Fuller, 1993; Kim & Winkler, 1995; Winkler, 1994, 1995). Since reidentification is probabilistic for data that have been blurred before release, the best approach for protecting confidentiality is to ensure that this probability is low enough to prevent a "data intruder" from assuming a match is correct.

Institutional Mechanisms

Privacy or Information Advocate

A *privacy or information advocate* is a one-sided intervenor (Kaufman & Duncan, 1988) whose mandate is to counterbalance power and resource inequalities among parties to a data dispute. At the US federal level, the Internal Revenue Service appointed Robert Veeder, a specialist in the Privacy Act and Freedom of Information Act at the Office of Management and Budget, to be the IRS's first privacy advocate. As an example of his activity, he presented a paper entitled, *Making Information Accessible While Protecting Privacy*, with Sara Hamer, Associate Commissioner of the Social Security Administration, to a seminar of the Federal Internet Institute in December 1997.

Privacy or information advocates act to right a power imbalance by championing the position of a weaker party. It is presumably difficult for an advocate to switch gears between privacy advocacy and data access advocacy. They are quite limited in their ability to address privacy and information disputes, as advocacy is their only tool. Access to advocates may be hindered if they are located within a bureaucracy, hence obstructing their visibility.

Privacy and Information Clearinghouse

A *privacy and information clearinghouse* provides a forum for intervention in disputes between information organizations and data providers as well as between information organizations and data users. It provides education and advice to those having questions and concerns about privacy and data access procedures.

An exemplar of such an institutional mechanism is the Privacy Rights Clearinghouse in California. It offers information on how consumers can protect their personal privacy. They provide a website at www.privacyrights.org/ and also operate a telephone hotline for those who seek information about privacy issues. The Privacy Rights Clearinghouse was established with funding from the Telecommunications Education Trust, a program of the California Public Utilities Commission. Some of their materials were developed through the University of San Diego, Center for Public Interest Law, which administered the PRC from its inception in 1992 to October 1996. Given the need for such a clearinghouse to have a reliable source of funding and appropriate administrative support, its existence is contingent on highly specific circumstances. It may not be possible to replicate these conditions in other states.

Ombuds

Another intercessory mechanism with one-sided characteristics is an *ombuds*. An ombuds works within an agency to deal with complaints by data providers or data users.

The federal government has recently taken a step in the direction of using ombuds mechanisms for information and privacy disputes. Office of Management and Budget Circular A-130 that was revised February 9, 1996 (see www.whitehouse.gov/WH/EOP/OMB/html/circulars/a130/a130.html), provides uniform government-wide information resources management policies. In Section 9a (10) it provides that an ombuds(man) be designated by each agency. The ombuds(man) is to be a senior agency official charged "to investigate alleged instances of agency failure to adhere to the policies set forth in the Circular and to recommend corrective action as appropriate."

An ombuds provides an alternative and generally easily identifiable complaint route for those in dispute with an IO. This increases the power of data suppliers and data users. An ombuds can only be responsive to IO-specific disputes. This mechanism is limited in flexibility because the ombuds can only direct and articulate concerns. In particular, the ombuds typically does not have mediation or arbitration powers. Access may of course be limited if the ombuds is hidden within the bowels of an IO's bureaucracy. It is essential that an ombuds be granted the authority to act with some neutrality.

Internal Privacy Review Board

The function of *internal privacy review boards* is akin to that of institutional review boards (IRBs) in universities. In fact, such IRBs could themselves provide "oversight mechanisms, with suitable definition of their scope to cover research uses of federal data sets, [to ensure that] adequate controls are in place to monitor compliance with data protection rules and regulations by users in the research community" (Duncan, Jabine, & de Wolf ,1993, p. 107).

The Bureau of the Census has a Microdata Review Panel that was formally chartered in 1981 (Cox, McDonald, & Nelson, 1986). It is charged with reviewing policies for the dissemination of microdata files, especially public use data tapes and CD-ROM products. With a similar charge, the National Center for Education Statistics has a Disclosure Review Board, which was created in 1989. It is staffed by NCES employees and a Census Bureau representative. In the private sector, the Inter-University Consortium for Political and Social Research frequently convenes ad hoc privacy review boards consisting of research and privacy experts.

An internal privacy review board can vary in its influence on the balance of power in privacy and information disputes, depending on how it sees its mandate. Some such boards may see their role as simply ensuring that extant administrative rules and legislative requirements are met. Others may be more actively involved in disputes between an information organization and their data providers or their data users. An internal privacy review board can be quite responsive to specific disputes. If it is granted adequate authority, it can employ a wide range of mechanisms to resolve disputes. Unless the board is specially constituted for this purpose, access to an internal privacy review board by data providers and data users may be quite limited.

Administrative Review Agency

An *administrative review agency* would derive its mandate from legislative or executive authority. It would function like the OMB Statistical Policy Office. While not having direct administrative responsibility for federal statistical agencies, the Statistical Policy Office provides long-range planning for statistical programs and coordinates statistical policy within the federal government. The office reviews all data collection requests developed by the Census Bureau and the Bureau of Economic Analysis. Other federal agencies submit their data collection requests, including those for statistical purposes, to OMB clearance officers who are not part of the Statistical Policy Office.

An administrative review agency typically would have as part of its charge the responsibility to ensure an appropriate balance of power among agencies, data providers, and data users. As constrained by its legislative mandate and resources, it could have wide-ranging responsiveness to privacy and information disputes, high flexibility in dealing with them, and potentially high access by concerned parties.

Perhaps consistent with this notion is the announcement on July 31, 1998, by vice president Gore that "OMB will be given responsibility for coordination of privacy issues, drawing on the expertise and resources of other government agencies. This will help improve the coordination of US privacy policy, which cuts across the jurisdiction of many federal agencies."

Data and Access Protection Commission

Perhaps the most elaborate institutional mechanism is an independent *data and access protection commission*. It would have legislative authority to regulate all stages of the information gathering and dissemination process by promoting accountability and fair information practices. In various ways such commissions have been implemented in Canada and several European countries (see Flaherty, 1989 for a detailed discussion of their operation). Canada has institutionalized a balance between data protection and data access. They have both a privacy commissioner and an information commissioner. The province of British Columbia combines these functions in a privacy and information commissioner. Both Australia and New Zealand have Privacy Commissioners; the United Kingdom has a Data Protection Registrar; Switzerland has a Data Protection Authority; Norway has a Data Inspectorate; and Spain has a Privacy Authority.

In the United States, most drafts of the Privacy Act of 1974 provided for a permanent privacy protection commission, but this provision was deleted before final passage. Recently interest in such a proposal has waxed and waned. In the House, Representative Wise introduced legislation in 1989 and 1991 to establish an independent data protection board. In 1995, Representative Collins introduced HR184 to amend the privacy provisions of the Privacy Act to improve the protection of individual information and to reestablish a permanent Privacy Protection Commission as an independent entity in the federal government. In the Senate, Paul Simon introduced Senate Bill 1735 in November of 1993 to establish a Privacy Protection Commission. The bill provided for an advisory and independent commission of five members to be appointed by the President, with the consent of the Senate, to serve staggered seven-year terms. More recently, in February 2001, Representative Asa Hutchison introduced HR 583, mandating the establishment of a federal commission for the comprehensive study of privacy protection to balance the protection of privacy while allowing appropriate uses of information. As of May 2002, no such bill had passed. Nonetheless, the repeated introduction of this provision, and its support from various bodies, including the National Academy of Sciences Panel on Confidentiality and Data Access (Duncan, Jabine, & de Wolf, 1993, Recommendation 8.5, p. 217), indicates the popularity of the concept.

Data Protection Commissioners could also assist in reviewing data provider-related disputes. The National Research Council's Panel on Confidentiality and Data Access recommended, "an independent federal advisory board charged with fostering a climate of enhanced protection for all federal data about persons and responsible data dissemination for research and statistical purposes." A data and access protection commission could have a legislative mandate giving it wide-ranging authority. Such authority might charge it with the responsibility to provide for a balance of power among stakeholders, to be broadly responsive to disputes about data, to be flexible in employing mechanisms to resolve disputes, and to provide easy access to all disputants. A commission could also serve as a liaison for the negotiation of international agreements regarding privacy and information issues.

Technical Procedures

Technical procedures for maintaining data confidentiality involve release of restricted data; techniques developed over the past twenty years have been proposed in both the statistical and computer science literature (Duncan & Pearson, 1991; Keller-McNulty & Unger, 1993; Fienberg, 1994). Unlike restricting access, restricting data is a technical device. It involves such methods as removing explicit identifiers and masking the sensitive data, e.g., grouping into categories or adding noise. By implementing data restrictions, agencies have operationalized statistical disclosure limitation practices. Some guidelines used by the European statistical system (Eurostat) are summarized in Manual on Disclosure Control Methods (1996).

Statistical disclosure limitation practices have allowed agencies to provide increasing amounts of data to the research community. Jabine (1993a) gives an excellent summary of statistical disclosure limiting practices for selected US agencies. The techniques proposed depend on the nature of the data, whether in tabular, microdata, or in on-line form.

Tabular Data

From demographic surveys frequency counts of variables such as age, sex, and race of responding individuals are tabled. Respondents can be identified, and so a disclosure occurs, with small counts in the cells of the table. If a table, for example, showed only one Asian female in a census tract and shows her as an orphan, then a disclosure has occurred. From establishment surveys variables such as Standard Industrial Classification Code and salary levels are used to create tables. For establishment data the disclosure issue is to avoid releasing information that will identify characteristics of particular establishments. As noted by Cox and Zayatz (1995), there are four principal methods for disclosure limitation of tabular data: cell suppression (Willenborg & de Waal, 1996), rounding (Cox, 1987), perturbation (Duncan & Fienberg, 1998), and modification of the underlying microdata (Griffin, Navarro, & Flores-Baez, 1989). A recent survey of disclosure limitation methods for tabular data is (Duncan et al., 2001)

Microdata

Microdata are records directly on the unit of analysis so may involve data about specific individuals or establishments. Because of the demand for more information than can be obtained from tables, public-use microdata files have been developed by some agencies. A public-use microdata file provides unrestricted access to restricted data. Public-use microdata files have been limited to data concerning individuals. Data on organizations tend to be more highly skewed than for individuals. The skewed distributions coupled with the time series and longitudinal nature of organizational data make many data restriction techniques, including top-coding, difficult. Consequently, very few public-use microdata files for organizations have ever been released. An important exception to this is the US Census of Agriculture, which beginning with the 1987 data has released microdata that has been disclosure limited through high levels of geographic aggregation and data categorization as well as being a five percent sample of farms (Kirkendall et al., 1994).

Online Data

Technological advances in computers and communications offer both opportunities and threats: opportunities to capture, analyze, store, and disseminate large databases more efficiently and threats of unauthorized access to individually identifiable data. Full use of the capability of today's information technology involves data access through on-line data query systems (McNulty & Unger, 1989). The data user directly requests all statistical analyses of interest. Steel and Zayatz (1998) lay out the technical procedures for disclosure limitation that will be used for the 2000 Census. In order that the released data products may have both higher quality and lower disclosure risk, they propose data swapping procedures that will target the most risky records. To allow broader and easier access to data and to allow users to create their own data products, they are deploying the American FactFinder system. Users can submit requests electronically.

CONCLUSIONS

> *Privacy is a basic American value—in the Information Age, and in every age. And it must be protected. We need an electronic bill of rights for this electronic age. You should have the right to choose whether your personal information is disclosed; you should have the right to know how, when, and how much of that information is being used; and you should have the right to see it yourself, to know if it's accurate.*
>
> *—Vice President Al Gore*

Agencies in the public sector play a key role in responding to this challenge. They are central in collecting and disseminating data that bear on the most important issues in the public interest. Advances in information technology, particularly the Internet, have multiplied the tension between demands for ever more comprehensive databases and demands for the shelter of privacy. In mediating between these two conflicting demands, agencies must address a host of difficult problems. These include providing access to information while protecting confidentiality, coping with health information databases, and ensuring consistency with international standards. The policies of agencies are determined by what is right for them to do, what works for them, and what they are required to do by law. They must interpret and respect the ethical imperatives of democratic accountability, constitutional empowerment, and individual autonomy. They must keep pace with technological developments by developing effective measures for making information available to a broad range of users. They must both abide by the mandates of legislation and participate in the process of developing new legislation that is responsive to changes that affect their domain. In managing confidentiality and data access functions, agencies have two basic tools: techniques for disclosure limitation through restricted data and administrative procedures through restricted access. The administrative procedures can be implemented through a variety of institutional mechanisms, spanning privacy advocates, internal privacy review boards, and a data and access protection commission. The technical procedures for disclosure limitation involve a range of mathematical and statistical tools. The challenge of developing and implementing these administrative and technical tools is great, and the value to society that the information agencies can provide is hard to overestimate.

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Chapter VI

E-Government: An Overview

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ABSTRACT

Information technology has fundamentally altered many aspects of daily life, including interactions with the government. The role of the Internet continues to increase as more citizens use it to find pertinent information, purchase goods and services, and to participate in virtual communities. By capitalizing on the Internet revolution, governments can create new channels of communication and new methods for participation via e-government. The changing environment, coupled with citizen and business demands, encourages government involvement in e-government initiatives and related uses of information technologies. This essay offers an overview of the historical premises, theoretical constructs, and associated typologies of e-government. These typologies posit a framework for understanding e-government, its potential benefits, and its related challenges.

INTRODUCTION

E-government (electronic government) has become a "buzz" word in local, state, and federal government. The era of e-commerce and e-business began with the widespread adoption of the Internet in the mid-1990s, and today many citizens expect the same responsiveness and access to government services as found in the private sector. According to the 2002 International City/County Managers Association e-government survey, over 73 percent of municipalities with populations larger than 2,500 have websites. The 2002 Pew Internet and American Life Project indicates that 58 percent (68 million people) of American Internet users have accessed at least one governmental website (Larson & Raine, 2002). Not only are citizens looking for improved ways to interact with the government, elected officials demand improved services to enhance their legacies. Competitive governments do not want to be seen as slow adopters of e-government (Sprecher, 2000).

Although there is widespread interest in the topic, e-government lacks a consistent, widely accepted definition. It is often related to revolutionizing the business of government through the use of information technology (IT), particularly Web-based technologies, which improve internal and external processes, efficiencies, and service delivery. The American Society for Public Administration (ASPA) and United Nations Division for Public Economics and Public Administration (UNDPEPA) have defined e-government as "utilizing the Internet and the World Wide Web for delivering government information and services to citizens" (UN and ASPA, 2001, p. 1). Based on this working definition of e-government, this article seeks to examine the theoretical constructs, historical premises, and associated typologies of e-government.

HISTORICAL PREMISES

E-government has evolved from the information technology revolution. Information technology enables new methods of production, increases the flow and accuracy of information, and even may replace traditional standard operating procedures (Landsbergen & Wolken, 2001). Information technology in government has long been acknowledged as a method for improving efficiency and communication (Norris & Kraemer, 1996; Kraemer & King, 1977). However, until the advent of the Internet, the use of technology in government primarily dealt with batch processing of mass transactions using mainframe computers. Now, IT developments such as electronic mail (e-mail) have changed interpersonal communications to eliminate the constraints of geography, space, and time, with profound organizational consequences (Rahm, 1999). The ability to buy and sell goods and services via the Internet has led to new private-sector industries, constituting a new business model which the public sector now seeks to emulate. In addition, IT has promoted globalization, which also changes the environment within which public agencies function (Kettl, 2000).

The main concerns of e-government now focus not only on the electronic dissemination of public information arising from traditional agency functions, but even more on reinventing agency processes to fully exploit the potential of information technology. As Fountain (2001) has noted, the reinvention process requires overcoming the rigidities and limits of traditional bureaucratic forms. Specific objectives may include the centralization of public data and the improvement of internal processes and communications (Alexander & Grubbs, 1998).

In detailing the history of e-government, it is important to note the distinctions between public-sector usage of information technology and e-government initiatives. Although there is a distinction between public-sector information technology and e-government, they are often interdependent and difficult to quantifiably separate; e-government is that subset of public information technology which involves delivery of government services and information to citizens, as defined by ASPA and the UN, cited earlier. This delivery of services and information also involves the integration of government networks and databases to allow for cross-agency communication and interaction, which is an internal technology application (Moon, 2002).

One of the first comprehensive visions of e-government is found in the 1993 National Performance Review report, *Creating a Government that Works Better and Costs Less: Reengineering through Information Technology* (Gore, 1993; Kim & Wolff, 1994). This report laid the groundwork for new customer- and client-oriented ways for agencies to engage citizens via technology, involving both improved agency processes and improved methods of delivery. Most reinventing government literature has cited the need to rely on information technology to improve citizen-centric government services (Osborne & Gaebler, 1992; Kettl, 1998). It is common for current works to refer to the symbiotic relationship between the earlier reinventing government movement and the current e-government movement (Scavo & Shi, 2000; Ho, 2002). But although the two movements are conjoined, the prospects are that the focus of public administration on e-government will endure for the foreseeable future, outlasting the reinventing government movement.

The 1995 amendment of the 1980 Paperwork Reduction Act (PRA) was another important milestone in the history of e-government. This amendment offered specific policies on issues associated with managing electronic information, including the establishment of standards, mandates for cross-agency information technology initiatives, and technology investment guidelines (Relyea, 2001). By outlining guidelines for information technology, the amended PRA solidified the government's commitment to improving citizen services via new channels based on technology. Several other pieces of federal legislation focusing on information technology and e-government followed the PRA, including the Electronic Freedom of Information Act Amendment of 1996.

The 1996 Electronic Freedom of Information Act (EFOIA) amendments added a new level of clarity to the issue of electronic records. This amendment extended the right of citizens to access executive agency records to include access to electronic formats and online information (Relyea, 2001). EFOIA also extended the time limits from ten to twenty days to prohibit the use of agency backlogs as an excuse for noncompliance with information requests (Hammitt, 1999). The 1996 Clinger-Cohen Act further heightened the role of information technology in government. It established a chief information officer (CIO) in every agency, making agencies responsible for developing an IT plan. Later, when e-government became a priority, the existence of the CIO strategic planning structure was an important element facilitating e-government implementation at the federal level.

Also in 1996, Congress passed the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA). This act, also known as the Welfare Reform Act, represented one of the first national pushes to incorporate the rhetoric of e-government with the routine services of agencies, specifically the administration of Temporary Aid to Needy Families (TANF). The act required interagency, interstate, and intergovernmental coordination of information technology systems to ensure that no individual exceeded the allotted five-year lifetime cap on assistance (Scavo & Shi, 2000). The failures associated with the PRWORA in terms of technology have been duly noted and offer a warning to e-government proponents about the harsh realities of creating interoperable, cross-platform systems.

In July 1996, President Clinton issued Executive Order 13011, which sought to improve management of information technology at the federal level. It also provided broad support for coordinated approaches to technology application in the Executive Office (Relyea, 2001). Although this executive order mandated implementation of and adherence to the PRA Act and the Clinger-Cohen Act, it also focused on the alignment of technology goals with strategic organizational goals. The support for interagency coordination of technology is codified in Executive Order 13011. Mandated goal alignment and technology investment reviews are included in the directive as a method for reducing the failure rates and cost overruns associated with federal technology initiatives.

More recently, in 2001 the E-Government Act was offered for consideration in the US Senate. This act, approved by the Senate in June, 2002, mandated the establishment of an e-government administrator in the Office of Management and Budget and also provided for considerable financial assistance to spur interagency e-government initiatives.[1] Each of these legislative actions has strengthened the federal government's commitment to e-government.

One of the most significant information technology developments at the federal level occurred after the tragedies of September 11th. The terrorist acts committed against the United States included the utilization of massive technology, notably the commercial aviation infrastructure, to perpetrate the crimes of mass destruction (Bonvillian & Sharp, 2001). The attack against America forced government officials to reexamine their information technology policies, infrastructure, and systems. The newly established Office of Homeland Security and its associated directives comprise the largest centralization and consolidation effort involving governmental databases in the history of the US. A recent General Accounting Office report (June 7, 2002) highlights this effort and its challenges by examining the types of necessary data, the amount of data, and the transmission format of the data across vertical and horizontal governmental lines. The report also notes the challenges associated with traditional agency "stovepipes" and the need to move beyond this approach towards a centralized, enterprise initiative (GAO, June 7, 2002, p. 8). The lack of connectivity and interoperability between databases and agency technologies is another crucial challenge that must be overcome, it is argued, in order to create a comprehensive infrastructure to deal with issues of terrorism.

Another example of the critical need to centralize and consolidate government information in order to mitigate future terrorist attacks is found in the Chambliss-Harman Homeland Security Information Sharing Act (HR 4598). This act, passed by the US House of Representatives in June 2002, mandates the dissemination of critical intelligence information from federal agencies, such as the CIA and FBI, to state and local governments (GCN, July 1, 2002). The goal of this act is to further reduce the vertical "stovepipes" that exist between federal, state, and local governments with respect to information access and to encourage data sharing across all branches and levels of government in order to foster coordination and collaboration.

Another result of the September 11th attacks is the renewed concern about security issues related to information technology. These increased concerns have caused governments to reexamine the information they provide online and, in some cases, to restrict access to such information. Section 204 of the

Homeland Security Act of 2002 allows the federal government to deny FOIA requests regarding information voluntarily provided by nonfederal parties to the Department of Homeland Security. Additionally, many government websites have removed potentially sensitive information. One example of the removal of sensitive governmental information involves the Department of Energy (DOE). According to the watchdog nonprofit organization, OMB Watch, the DOE has removed detailed maps and descriptions of nuclear facilities with weapons-grade plutonium and uranium from its website (OMB Watch, 2002).

Although the effects of September 11th have impacted the use of information technology in the public sector in a variety of ways, there is little doubt that citizen demand for electronic information and services is likely to continue the trend of e-government adoption and expansion. According to the 2002 Pew Internet and American Life Project, Americans continue to use the Internet to access government information, research policy issues, contact elected officials, and participate in e-democracy in increasing numbers (Larson & Raine, 2002). The number of Americans who have accessed government information online was 68 million in January 2002, compared with 40 million in March 2000. This marked increase further supports the idea that citizen demand for and use of e-government will continue to expand in the future.

THEORETICAL CONSTRUCTS

E-government has been viewed in a variety of ways. One context for examining e-government centers on recognition that e-government is more than just a shift in communication patterns or mediums. At least potentially, it involves a transformation of the organizational culture of the government. Recent authors argue that governments are mandated by citizen and business demands to operate within new structures and parameters precipitated by information technology (Osborne & Gaebler, 1992; Heeks, 1999; Bovens & Zouridis, 2002; Ho 2002). Current demands require crosscutting services, which in turn require government to improve communication and interaction across traditional bureaucratic lines (Alexander & Grubbs, 1998). These new requirements, which fundamentally alter the nature of government, are made possible through the strategic use of information technology.

Garson (1999) has divided the theoretical frameworks of e-government into four main areas: decentralization/democratization, normative/dystopian, sociotechnical systems, and global integration theories. The first two suffice to explain basic variations in e-government theory. The decentralization/democratization theory of e-government revolves around the progressive potential of technology and focuses on the positive governmental advances associated with e-government. Normative/dystopian theory emphasizes the high rate of conflict and failure associated with information technology applications and counters the positivist progressivism of decentralization/democratization theory with a realist view of inherent technological limits and contradictions. Each school of thought has its proponents as well as its critics. While neither framework can be considered fully descriptive, taken together they provide a useful delineation of the theoretical literature on e-government.

Decentralization/democratization theory is the most commonly held orientation associated with e-government. In fact, articles beginning with Bozeman and Bretschneider's seminal article in 1986 refer to the transformational, progressive nature of technology adoption in the government sector. Others have concluded that e-government and associated information technology adoption lead to shifting paradigms, extending beyond the notion of simple progress (Reschenthaler & Thompson, 1996; Ho, 2002). Reschenthaler and Thompson (1996) are among theorists who note the revolutionary potential of information technology in government. They contend that the power of e-government technology lies in its ability to even the playing field for all sizes and types of governments. Additionally, they see in e-government the basis for reengineering the business of government, refocusing its work on the needs of the citizens, and returning government to its core functions (Reschenthaler & Thompson, 1996). Other authors have also used the decentralization theory to highlight the transformational components of information technology and e-government.

Some authors examine the traditional bureaucratic model of public service delivery (the Weberian model), which highlights specialization, departmentalization, and standardization (Ho, 2002; Weber, 1947). This traditional model has created the "stovepipes" associated with government, those departmental silos that resist functioning across agency boundaries. The main promise of the Weberian model is to ensure that all citizens are treated equitably with the utmost efficiency. However, in the 1990s, the reinventing government movement sought to alter the core focus of government, moving from departmentalization and centralization to citizen-centric decentralization (Osborne & Gaebler, 1992), much in contrast to the Weberian model.

According to Ho (2002), the e-government paradigm, which emphasizes coordinated network building, external collaboration, and customer services, is slowly replacing the traditional bureaucratic paradigm and its focus on standardization, hierarchy, departmentalization, and operational cost-efficiency. The new paradigm mirrors many of the tenets of the reinventing government movement, including user control and customization, flexibility in service delivery, horizontal and vertical integration culminating in “one-stop” shopping, and innovative leadership focused on the end user (Osborne & Gaebler, 1992; Ho, 2002). This paradigm shift is precipitated by the advent of the Internet, which provides government the ability to use technology to impact customers directly, instead of simply reengineering internal processes (Scavo & Shi, 1999).

A core concept of e-government, which falls under the decentralization orientation, is the idea of using technology as a link between citizens and government. According to the work of Milward and Snyder (1996), the governmental use of information technologies to engage and interact with the public further enhances the value of technology adoption, which in turn leads to greater e-government penetration. IT technology can be substituted for other governmental institutions to link citizens to government services. This linkage causes both the citizens and the government to become reliant upon IT functions, increasing the penetration and adoption rates of e-governmental.

As governments federal, state, and local become more involved in information technology and gain recognition for their e-government efforts, other jurisdictions not currently engaged in e-government will increasingly become interested in and adept at this form of information technology usage (Norris, 1999). That is, the decentralization theory predicts that e-government’s diffusion will snowball as its benefits to citizens and to the agencies themselves are demonstrated.

Technology and e-government adoption rates are a key interest of decentralization proponents. In fact, the argument is virtually tautological—in order to define the factors that increase e-government penetration and adoption, one must believe in the positive potential of the concept. In terms of information technology adoption and implementation, the greater the number of governments planning for and using information technologies and e-government approaches, the more legitimacy the technology gains (Fletcher, 1999). It is evident from the proliferation of e-government activities at the federal and state level that the widespread benefits of using information technology to provide more timely, seamless government services is a legitimate, even preferred, method of action. Citizen and business demands for e-government applications have extended to the local government level; and as more local governments begin using e-technologies, the legitimacy of the applications will further increases (Norris, Fletcher, & Holden, 2001).

By adopting new technologies, governments may be able to respond to the changing environment with improved service delivery, increased efficiency, and reduced costs (West, 2000). The use of e-government applications allows governments to more readily engage citizens and businesses in a virtual world that is thought to be more responsive and accountable to the needs of the customer. However, there is a marked lag in government adoption of new technologies and methodologies compared to implementation in the private sector.

The structural inertia that afflicts most governments, as well as risk aversion, means that governments are slow to adopt and implement new technologies. According to Herbert N. Casson, the government was one of the final sectors to adopt the telephone, approximately ten to fifteen years after its distribution to the public at large (Relyea, 2001). The lag associated with governmental adoption of new technologies continues today. In fact, research decades ago by Kraemer, Danziger, and King (1978) indicated that local government, in general, has had about a ten-year lag time between the introduction of new technology and its adoption and use in localities. Furthermore, smaller local governments have a lag adoption time of 15 years or more. For government information technology adoption and implementation, the inertia that exists within the public sector means that organizations are often less willing and able to engage new technologies (Bretschneider, 1990). The inherent tension between the need for reliability and accountability contrasted with reliance on maintaining organizational status quo leads to the increased adoption lag time in governmental organizations.

Support for e-government is allied with the decentralization theory, which offers optimistic prospects for the future of virtual governance. However, the stark reality of public technology and e-government failures has been repeatedly noted in news media. The concerns associated with privacy, security, and the digital divide are all common threads under normative/dystopian theory, which offers a critical approach to evaluating e-government. Proponents of this view of e-government are traditionally concerned with the dehumanizing and isolating aspects of information technology. Recent concerns about the "digital divide," the technology gap that exists between certain sub-populations in the US, highlight the problems of fairly implementing technology as a mode of communication and service delivery. Fisher (1998) notes the disparity in power and access to technology that occurs in distinct sub-populations when analyzing grassroots social movements. His findings are consistently supported by other studies that note racial, regional, educational, gender, and age disparities among Internet users and technology owners (Novotny, 1998; Norris, 2001).

Bovens and Zouridis (2002) highlight the dystopian framework of e-government by examining the inherent problems associated with the application of information technology and the shift toward an e-government paradigm in real-world settings. They contend that the emerging emphasis on information technologies as the medium for citizen interaction with government fundamentally alters the role of the bureaucrat. The traditional Weberian model uses street-level bureaucrats to interact with citizens and to determine the proper services and service levels to assist these citizens (Lipsky, 1980). However, as technology becomes more integrated into government agencies, computer programs are often used to interface with clients, determine eligibilities, and decide upon proper levels of service (Boven and Zouridis, 2002). As a result of this new computer-based assessment trend, the street-level bureaucrats are losing their discretionary power. Bovens and Zouridis (2002) do not presuppose to judge the new, non-discretionary technology models but, rather, use the paradigm shift to focus on the risks of arbitrariness and associated threats to the legitimacy of governmental actions at the street level.

TYPES OF E-GOVERNMENT

Although several typologies have been developed to explain the progression of e-government (Layne & Lee, 2001; Moon, 2002), the UN and ASPA definition of the stages of e-government maintains continuity with the working

Figure 1. E-Government Typology

Stage	**Orientation**	**Services**	**Technology**	**Citizens**
Stage One: Emerging Web Presence	Administrative	Few, if any	Only Web	Going it alone
Stage Two: Enhanced Web Presence	Administrative, Information	Few forms, no transactions	Web, e-mail	Links to local agencies
Stage Three: Interactive Web Presence	Information, Users, Administrative	Number of forms, on-line submissions	Web, e-mail, portal	Some links to state and federal sites
Stage Four: Transactional Web Presence	Information, Users	Many forms and transactions	Web, e-mail, digital signatures. PKI, portals, SSL	Some links to state and federal sites
Stage Five: Seamless Web Presence	Users	Mirror all services provided in person, by mail, and by telephone	Web, e-mail, PKI, digital signatures, portal, SSL; other available technologies	Crosses departments and layers of government

Source: Adopted from UN and ASPA, 2001 and Ho, 2002 definition set forth at the outset of this essay. It is also important to note that the stages to be discussed do not represent a true linear progression, nor are they specific block steps. Rather, the stages are a continuum in which governments can be within the same stage with very different functionalities and service offerings.

According to the UN and ASPA (2001), there are five main stages of e-government. Figure 1 offers a side-by-side comparison of the major components of the five stages of e-government. Each of the stages is discussed in further detail below.

The lack of an organizational web site is not defined by a stage, but may be considered Stage 0. Stage 1 is the emerging Web presence, which involves static information presented as a type of online brochure (UN and ASPA, 2001, p. 16). The main goal of the emerging Web stage is to provide an online mechanism for communicating key general information about the government to interested citizens and entities. The website lacks information about services and is not organized in a citizen-focused manner. Typically, the government has used a "go it alone" approach, which visually represents the "stovepipes" that exist within agencies—there is little coordination across agencies and levels of government in Stage 1 websites.

In Stage 2, enhanced Web presence, the role of the website becomes associated with information on services, although it is still organized by departments rather than by user groups. Enhanced Web presence sites typically have e-mail as a means of two-way communication. However, rarely are there available forms for download. Stage 2 offers limited communication and greater information about the services of the government, but it does not meet the citizen-centric approach that has been advocated for e-government (UN and ASPA, 2001, p. 17).

Stage 3, interactive Web presence, begins to move into the citizen-centric realm of e-government (UN and ASPA, 2001, p. 18). Typically, the information is portrayed by intuitive groupings that cross agency lines. For example, the website might use a portal as the single point of entry into various departments and service areas. The portal would offer major groupings like business, new resident, seniors, children, or other standard groups. Then, the end user would select the grouping that applies and be launched into a new section of the portal where the most common services requested for the group are located. The services would not be listed by departmental areas, but rather by functional areas. Stage 3 sites have downloadable forms with online submissions, e-mail contact for various governmental employees, and links to other governmental websites.

Stage 4, transactional Web presence, offers the ability to conduct secure online transactions (UN and ASPA, 2001, p. 19). This stage is also organized by user needs and contains dynamic information. The website may offer a variety of transactions, including paying for services, paying bills, and paying taxes. Transactional Web presence includes online submission of forms, many downloads, e-mail contact, and several links to other governments. The use of digital signatures also falls under Stage 4.

The final stage, Stage 5, involves seamless government. Although this stage represents an ideal, there is no real example of its application. Stage 5 involves a cross-agency, intergovernmental approach that only displays one front, regardless of service area (UN and ASPA, 2001, p. 20). For example, a seamless website would offer local, state, and federal government services via the state portal without the end user recognizing what level of government provides the service. A Stage 5 site would offer vertical and horizontal integration and would require true organizational transformation with respect to administrative boundaries (UN and ASPA, 2001, p. 20). The closest example to seamless government is the FirstGov website created by the federal government of the United States. However, even this site lacks the coordination and cooperation required to make seamless government a reality.

With a working knowledge of the typology associated with e-government, it is easy to assess the current status of the concept. Much of the literature indicates that Stage 2, enhanced Web presence, is the typical placement of an American local government on the continuum. Alexander and Grubbs (1998) note: “Few sites capitalized on the interactive nature of the Internet to conduct public discussions, maintain bulletin boards, or provide data and information available for download” (p. 3).

In his analysis of the 2000 International City/County Managers Association’s (ICMA) E-Government Survey, Moon (2002) finds that a majority of municipalities with populations over 10,000 are not offering transactional websites. Furthermore, based on the 2002 ICMA E-Government Survey, only 62 (1.7 percent) municipalities offer online payment of taxes, 113 (3.1 percent) offer online payment of utility bills, and 91 (2.5 percent) offer online payment of fines and fees. The percentages for counties are only slightly higher, with 69 (16.3 percent) offering online payment of taxes, 17 (4.0 percent) offering online payment of utility bills, and 21 (5.0 percent) offering online payment of fines and fees. The state and federal governments offer more robust transactional services, which is to be expected based on information technology diffusion patterns.

A different dimension of e-government typology is the orientation of the website. There are three primary orientations identified by Ho (2002) in his analysis of city websites. These orientations are designed to demonstrate the shift from the Weberian bureaucratic model to the e-government paradigm. The first orientation involves administrative-oriented websites. These sites are organized along departmental lines and represent the traditional bureaucratic paradigm (p. 437). The second orientation is information-oriented, which offers the one-stop shop concept via the homepage of the government unit (p. 437). This design crosses departmental lines in order to provide comprehensive information in a centralized location. The final orientation is user-oriented. This design attempts to categorize information in intuitive groupings that enable the end user to quickly select their grouping and retrieve only the information that pertains to them (p. 437). As in information orientation, the user-oriented site traverses departmental boundaries in order to provide a specialized one-stop shop. Ho's analysis of the 55 largest municipalities' websites indicates that a majority have moved toward varying degrees of user orientation (p. 438). Again, this finding is consistent with the main predictor of early information technology adoption, population size (Bozeman and Bretschneider, 1986; Scavo and Shi, 2000; Moon, 2002).

It is important to note that the UN/ASPA typology uses customer orientation to define its various stages. The highest level of e-government highlights the presentation of a seamless government to the end users of the governmental website. Seamless government goes beyond interagency and interjurisdictional coordination to include full vertical and horizontal integration based on client needs. The constructs developed in the UN/ASPA typology are consistent with the decentralization/democratization approach to understanding e-government. Both the approach and the typology view e-government as a transformational tool that engenders a new governmental paradigm, based on citizen-centric services.

There are alternative approaches to defining the e-government typology, which are more readily associated with the dystopian orientation. This typology uses various levels of communication, applications of technology, and citizen participation in democratic forums to define its stages. One example of this approach is found in Moon's typology (2002), as adopted from Hiller and Bélanger. This framework also uses five stages, but its focus is on the communications between various stakeholders, including government to government (G2G), government to employee (G2E), and government to citizen (G2C). Stage 1 involves information dissemination, similar to Stage 1 of the decentralization model. The technologies used are basic Web authoring tools and bulletin boards (p. 426). Stage 2 involves two-way communication, facilitated by electronic data interchange (EDI), and email. Service and financial transactions compose Stage 3, along with technologies like EDI, electronic filing systems, digital signature, and public key infrastructure. Stage 4 incorporates vertical and horizontal integration of the technologies found in Stages 1, 2, and 3. Stage 4 is similar to the seamless government approach outlined in Stage 5 of the decentralization model. The final stage for the dystopian model highlights political participation. It allows for voting online and using technology to foster democracy and participation. This alternative approach to the typology of e-government allows a citizen-centric vision but also centers on digital civic engagement and the power of the Internet to enhance democracy.

CONCLUSION

Information technology has fundamentally altered the way we interact in today's society. The role of the Internet continues to increase in society as connectivity becomes more readily available to disparate geographical and demographic sectors of the United States. E-government offers an opportunity to create new channels of communication and new methods for participation. Success of existing e-government efforts provides increased legitimacy for further information technology adoption (Norris, 1999). The changing information environment and the movement toward the knowledge economy, juxtaposed against citizen and business demands, mandates that government become involved in e-government initiatives and related uses of information technologies (Ho, 2002).

Although e-government has been offered as a panacea to the ills of the public sector, it has not yet achieved the massive reform and reorientation promised by its proponents. In fact, the e-government movement, similar to other management movements such as total quality management (TQM), new public management, and the reinventing government efforts, has not been successful in altering the core structures of government or avoiding its associated failures (Scavo & Shi, 2000). Leading observers such as Fountain (2001) continue to emphasize the formidable obstacles to higher types of e-government posted by the inertia of sunk investment in existing governmental structures and their associated vested interests.

The structural inertia that afflicts most governments, as well as a propensity toward risk aversion, means that governments are slow to adopt and implement new technologies. Given the documented lag time for technology adoption in the public sector, public-sector realization of the power of the Internet and e-government must be seen as still nascent at best. By understanding the theoretical premises that underlie e-government and public information technology, programs and processes can be designed to assist government in reaping the benefits associated with strategic use of information technology and e-government.

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ENDNOTES

[1] At this writing, the E-Government Act was still in House committee.

Part II

Computer Applications in Public Administration

Chapter VII

Leading-Edge Information Technologies and American Local Governments

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ABSTRACT

In this study, I examine the adoption, penetration and impacts of the adoption of leading-edge information technologies in American local governments. I also discuss future trends with respect to these technologies. Data for this study come from three nationwide surveys of information technology in local governments and a series of case studies in US cities about the adoption of leading-edge information technologies.

My principal findings are that American local governments have adopted a range of these technologies and can be expected to do so in coming years. This is especially true of the adoption of electronic government. Local government characteristics associated with adoption include principally local government size as measured by population. Other characteristics include type and form of government, region of the country, and metropolitan status. Additionally, local governments adopt leading-edge information technologies for both general reasons (e.g., to improve efficiency and effectiveness) and to solve specific problems (e.g., the adoption of automated fingerprint identification systems to solve crimes).

Finally, future trends can expect to see American local governments adopt more leading-edge technologies, in part because local governments believe that they produce largely positive results. These technologies will continue to penetrate local government organizations more deeply, and, thus, provide greater payoffs. Finally, as newer and more sophisticated information technologies are adopted, local governments will necessarily have to provide more integration and support for them.

INTRODUCTION

Nearly all of American local governments of any size routinely use information technology (IT) in their operations. Indeed, local governments deploy IT for a wide array of activities covering most, if not all, of the functional areas of local government—literally from accounting to zoo operations. Survey data from a decade ago found that 97 percent of all cities used computers, including: 100 percent of cities over 50,000 in population; 97 percent of those between 10,000 and 49,999, and 93 percent of those under 10,000 (Kraemer & Norris, 1994). A more recent survey of IT in local governments, this one conducted in 1997, found a similar pattern of computer adoption among US cities. Here again, 97 percent of all cities had adopted computers. This included 100 percent of cities over 50,000; 99 percent of cities between 10,000 and 49,999, and 95 percent of cities under 10,000 (Norris & Demeter, 1999). These adoption data compare with figures from a 1975 survey which found that 98 percent of cities over 100,000 used computers, as did 92 percent of those between 50,000 and 99,999, while only 42 percent of cities between 10,000 and 49,999 used computers (Kraemer & Norris, 1994).

Additionally, a large majority of local governments (over 83 percent) have established sites on the World Wide Web in order to provide information and deliver governmental services. That is, they have adopted electronic government (e-government), defined as the electronic delivery of information and services by governments 24 hours per day, 7 days per week. (Norris, Fletcher, & Holden, 2001; Holden, Norris, & Fletcher, forthcoming).

These surveys and other studies clearly show that both IT and e-government have thoroughly penetrated an entire organizational sector of the American society, local government. However, penetration tells us very little about the innovativeness and sophistication of IT and e-government applications and even less about nascent trends in IT and e-government use among local governments. Although local governments make extensive use of IT in their daily operations and most have also widely adopted e-government, these governments may use IT in general and e-government in particular primarily in mundane ways. It may also be that only a relatively few local governments have adopted more innovative information technologies that do more than automate routine activities. And, what does the future hold in store? In coming years, are local governments likely to adopt more advanced and sophisticated information technologies and to broaden further their deployment of e-government?

In the past, most pay-offs from computing were attributed to more routine applications, especially those with substantial record-keeping elements (Northrop et al., 1990). Today, however, because of advances in hardware technology and in application software, it is conceivable that payoffs may occur as the result of technological sophistication and the use of more advanced and, hence, more innovative information technologies. Indeed, the use of more advanced and sophisticated or what might be called "leading-edge" information technologies may well provide local governments with results that could not be obtainable from routine applications.

One example that comes to mind is AFIS technology. Police departments that have adopted Automated Fingerprint Identification Systems (AFIS) report stunning improvements in clearing cases in which latent fingerprints were essentially the only evidence available. Without AFIS, most of these cases would never be solved. This is because it would not be feasible to staff a police department fingerprint section with a sufficient number of personnel to be able to sort and match latent prints manually against all fingerprints on file. In this case, an advanced IT is a necessary prerequisite to getting the job done.

Another example is e-government. The rhetoric surrounding the adoption of e-government suggests that this innovation will enable local governments to reduce costs and improve service delivery (Ho, 2002; Moon, 2002; Holden, Norris, & Fletcher, forthcoming). However, data from the few studies of e-government currently available indicate that this potential has not yet been realized (Moon, 2002; Holden, Norris, & Fletcher, forthcoming). This may well be because most e-government sites are relatively new and are not especially sophisticated. For example, today few offer truly interactive, transactional capabilities.

Additional evidence to suggest that greater sophistication may produce greater payoffs from use comes from a study that found a direct relationship between whether a city had a central computer system and the extent that it had adopted innovative applications (Norris & Kraemer, 1996). The authors found that

> *[I]n cities with central systems, the technology is more sophisticated, is more widely diffused within the various functions of city government, and is used by a greater proportion of managers and professionals. (p. 574)*

One of the reasons for this was that in cities with central systems, IT had become more "institutionalized as a source of technical expertise and a provider of day-to-day computer services" than in cities that lacked central systems (Norris & Kraemer, 1996, p. 574). Hence, the technical and managerial capacity existed to foster and support more innovative and sophisticated applications. This, in turn, led to greater use and greater benefits from use.

LEADING-EDGE INFORMATION TECHNOLOGIES

In this chapter, I discuss leading-edge information technologies and their adoption by American local governments. By information technologies, I mean nearly any technology that is based on the use or deployment of computers and computerized devices and that involves the collection, storage and manipulation of data and information. By leading edge, I mean information technologies that are currently on the vanguard (hence, "leading edge") of innovation adoption by municipal governments. This means that one important characteristic of leading-edge ITs is that they have, almost by definition, been adopted by relatively few local governments. Indeed, the fact that these technologies have been adopted by relatively few local governments strongly suggests that the act of adopting them is an act of innovation by those governments (Rogers, 1983).

It is useful to distinguish here between *leading*- and the *bleeding-edge* technologies. Being on the *leading edge* of a technology innovation means to be among the first wave of adopters of a *proven* technology. Innovation in the form of early adoption in such a case, while carrying some risk, is not inherently risky. Being on the *bleeding-edge* is much riskier (and, therefore, in the world of local government, generally is not recommended), because it involves being among the first adopters of a technology that has not been tested and proven in the field (e.g., being a beta site for a new technology). Many a local government system project has foundered in precisely this manner. Consequently, few local governments want to find themselves on the bleeding edge of technology innovation.

Leading-edge information technologies tend also to have a second important characteristic. Many of them are relatively more sophisticated than information technologies used for more routine functions. These information technologies require more than just basic hardware and software, perform other than routine applications, involve both multiple departmental or functional area users, and require advanced knowledge and skills to operate. This characteristic is certainly observable in such leading-edge information technologies as GIS, AFIS, electronic government,[1] and others. In this chapter, I include both adoption rates and sophistication to define leading-edge information technologies.

METHODOLOGY

I compiled a list of leading-edge information technologies from four sources: two surveys conducted by the International City/County Management Association and Public Technology, Inc. (ICMA/PTI, 1993 and 1997), a series of case studies of leading-edge information technologies in city governments conducted by researchers at the University of Maryland, Baltimore County (UMBC) (Norris, 1999; and Norris and Fletcher, 1999), and an ICMA/PTI survey in the winter of 2000 on the adoption of e-government by American local governments. The findings from these sources provide the principal (though not sole) data that inform this chapter.

I began with those information technologies listed in the 1993 ICMA/PTI survey (Norris and Kraemer, 1994.) This survey asked cities whether they had or were considering a number of potential leading-edge information technologies (Table 1). An application was selected as being on the leading edge of municipal innovation from the 1993 survey if at least 10 percent but not more than 50 percent of responding cities had adopted it. The 10 percent base represented a minimum threshold of adoption. In essence, this meant that enough cities had adopted an IT that it could be considered to be at the beginning of a trend toward broader adoption and, therefore, on the "leading edge" of adoption among all cities. At the level of adoption of 50 percent or greater, the IT was no longer on the leading edge, but instead was verging on common rather than innovative usage. Using these criteria, an initial list of leading-edge information technologies was developed from the 1993 survey. This list is found in Table 2.

A second source of information about leading-edge information technologies comes from the UMBC case studies (Norris, 1999; Norris & Fletcher, 1999). These case studies involved in-depth examination of the adoption, uses,

Table 1. Potential Leading Edge Information Technologies, 1993

Technology	% Adopted	% Considering
24 Hour City Hall	2.5	13.4
AFIS	7.3	12.6
Bar Code Technology	14.4	25.8
CD ROM	16.3	22.1
Electronic Mail	21.1	15.4
External Databases (Use of)	26.0	NA
Fax Modems	17.1	18.4
Fiber Optic Cable	7.9	9.2
GIS	16.5	26.0
Imaging	5.2	15.9
Interactive Video Training	5.7	7.3
Local Area Network	48.1	NA
Long Range IT Plan	13.1	NA
Multimedia	4.3	13.8
Optical Disk Storage	5.9	23.6
Portable Computers	30.7	17.3
Public Access Network	2.8	11.7
Scanners	24.0	19.1
Smart Traffic Monitoring Systems	4.4	2.9
Smart Public Buildings	1.3	3.7
Smart Highway	0.9	3.6
Smart-coded Toll Booths and Parking	0.7	1.0
Video Arraignments	1.7	3.5
Virtual Reality	0.4	2.6
Wide Area Network	5.6	7.6
Wireless LAN	2.0	8.8

Source: 1993 ICMA/PTI Information Technology Survey.

Table 2. Leading Edge Information Technologies, 1993

Technologies	% Adopted
Bar Coding	14.4
CD ROM	16.3
Fax Modems	17.1
Fiber Optic Cable	7.9
Imaging	5.2
LAN	48.1
Optical Disk Storage	5.9
Scanners	24.0
WAN	5.6
Applications	
AFIS	7.3
Electronic Mail	21.1
External Databases	26.0
GIS	16.5
Procedures	
Long Range IT Plan	13.1

Source: Norris and Kraemer, 1994.

and impacts of leading-edge information technologies in 14 American cities. Potential sites for case studies were initially identified using the 1993 ICMA database. In addition, cities that for other reasons (such as reputation) were considered innovative (e.g., Seattle, Washington and San Diego, California—neither of which had responded to the ICMA survey) were added to the list of potential case study sites.

A list of what were believed to include the most important leading-edge information technologies, circa 1995, was developed, partly based on the 1993 ICMA survey list (Table 3). Next, the cities were screened via telephone to determine if, in fact, they had adopted these (or other) leading-edge information technologies. As a result of the telephone interviews, several cities were

Table 3. Leading Edge Information Technologies for Screening Potential Case Study Cities, 1995

- AFIS
- Central IT Department
- CD ROM
- Computer-based Training
- Electronic Data Interchange
- Electronic Mail
- External Databases (use of)
- Fax Modems
- Fiber Optic Cable
- GIS
- GPS
- Handheld Computers and PDA's
- Imaging
- Integrated Voice, Data and Video
- Internet Access and Use
- Long Range IT Plan
- Multi-media
- Public Access Technologies
    - Kiosks
    - Dial-up Access
    - BBS
    - ATM
    - Public Use Terminals

Source: Norris, 1999; and Norris and Fletcher, 1999.

Table 4. Cities in UMBC Leading Edge Information Technology Study

City	Population [a]	Region [b]	Form of Government
Boston, MA	547,000	NE	MC
Charlotte, NC	396,000	S	CM
Denver, CO	468,000	W	MC
Indianapolis, IN	731,000	NC	MC
Jacksonville, FL	635,000	S	MC
Mobile, AL	196,000	S	MC
New Orleans, LA	497,000	S	MC
Overland Park, KS	111,800	NC	CM
Philadelphia, PA	1,586,000	NE	MC
Richmond, VA	203,000	S	CM
San Diego, CA	1,110,500	W	CM
St. Paul, MN	272,000	NC	MC
Scottsdale, AZ	130,000	W	CM
Seattle, WA	516,000	W	MC

Source: Norris, 1999; and Norris and Fletcher, 1999.
Notes: a. ICMA regions; b. population derived from 1990 Census.

eliminated because they failed to meet the criteria of adoption, and one city declined to participate in the study.[2] This left a final selection of 14 cities. Each of these cities had adopted at least 14 of these 18 technologies (Table 4).[3]

EXTENT OF ADOPTION

Perhaps the first thing that should be noted is that overall American local governments are not especially innovative in their adoption of information technologies. The data from the 1993 ICMA survey, for example, show that only one of the leading-edge information technologies listed had been adopted by something approaching half of all cities (the LAN or local area network), while one other (portable computers) had been adopted by nearly a third. Three (external database use, scanners, and e-mail) had been adopted by

Table 5. Adoption Rates of Leading Edge Information Technologies, 1997

Technology	% Adopted	% Considering
AFIS	7.9	12.0
CD ROM	18.4	27.1
Direct Broadcast Satellite	2.4	3.2
Fax-back/Reply Service	14.5	1.8
Fiber Optics	16.9	14.2
GIS	28.7	27.1
GPS	7.7	15.0
Interactive Teleconferencing Facilities	2.7	10.1
Intranet Server [a]	10.7	22.5
Kiosk	2.5	14.0
Laptops (Use of)	51.2	13.2
Local Area Networks	69.9	NA
Long Range IT Plan	26.8	NA
Personal Digital Assistance [b]	2.6	4.6
Satellite Imagery/Data	2.1	4.0
Smart-coded Toll Booths	0.5	0.8
Video Arraignment	3.0	4.8
Virtual Reality Training	1.5	3.2
Wireless Services (Mobile radios and cellular phones)	49.5	7.2
WWW Site On Internet [c]	37.5	30.1

Source: 1997 ICMA/PTI Information Technology Survey.
Notes: a. The survey asked “Does the city plan to have one?” b. A misprint in the survey; should be “Assistant.” c. The survey asked “Do plans exist to create a site?”

between 20 and 30 percent of cities. Five others (CD ROM, Fax Modems, Long-range IT plan, and GIS) had been adopted by between 10 and 20 percent. The remaining 16 leading-edge information technologies on the list had been adopted by fewer than 10 percent of cities. Note that the 1993 survey did not contain questions about e-government or about local government adoption of sites on the WWW. I will discuss e-government adoption presently.

In 1997, the ICMA and PTI conducted another survey of IT in cities. This survey also contained questions about leading-edge technologies (unfortunately, however, the questions in the 1997 survey were not directly comparable to those in the 1993 survey). Table 5 contains the adoption rates of the leading-edge information technologies listed in that survey.

The data in Table 5 reinforce the conclusion that American local governments are not in the forefront of innovation with IT. Of the potential leading-edge information technologies included in the 1997 ICMA/PTI survey, 10 of 18 had been adopted by fewer than 10 percent of US cities. Four had been adopted by over a quarter of cities, including wireless services (49.5 percent); [4] WWW site on the Internet (37.5 percent); GIS (28.7 percent); and a long-range IT plan (26.8 percent). Two more have been adopted by between 15 and 25 percent of cities: CD ROM (18.4 percent), and fiber optic cable (16.9 percent). And, two more by between 10 and 15 percent: fax-back/reply service (14.5 percent), and intranet server (10.7 percent).

Regarding e-government adoption, local governments have embraced this technological innovation perhaps more rapidly than any other in IT history. For example, in 1995, only about 8.7 percent of local governments had WWW sites (Sprecher, Talcove, & Bowen, 1996).[5] By 1997, this figure had increased more than four-fold to 40 percent (Norris & Demeter, 1999) and by late 2000 had doubled to 83.7 percent (Norris, Fletcher, & Holden, 2001; Holden, Norris, & Fletcher, forthcoming). Other studies confirm the rapid adoption of e-government by American local governments (e.g., West 2002, 2001).

At least some of the survey data, however, can be somewhat misleading. As the UMBC case studies discovered, what cities report on surveys and what is actually in place are sometimes subtly or even dramatically different. For example, many GIS systems are that in name only. Some are little more than computer-assisted drafting (CAD) systems. Still others are in the early phases of development and are not widely deployed or used. Likewise, the mere adoption of an e-government site on the WWW does not say much about the sophistication of that site. As Pardo (2000, p. 1) has noted: anyone "can build a Web site, . . . but digital government is more than that."

Table 6. Adoption Rates of Selected Leading-Edge Information Technologies 1993 and 1997[a]

	1993		1997	
Technology	% Adopt	% Consider	% Adopt	% Consider
AFIS	7.3	19.9	7.9	12.0
CD ROM[b]	16.3	38.4	18.4	27.1
Electronic Mail[c/d]	21.1	15.4	74.6	NA
Fiber Optic Cable	7.9	17.1	16.9	14.2
GIS	16.5	42.5	28.7	27.1
LAN[d]	48.1	NA	69.9	NA
Long Range IT Plan	13.1	NA	26.8	NA
Portable Computers[d/e]	30.7	48.0	51.2	NA
Smart-coded Toll Booths [f]	0.7	1.0	0.5	0.8
Video Arraignment	1.7	3.5	3.0	4.8
Virtual Reality	0.4	2.6	1.5	3.2

Source: 1993 and 1997 ICMA/PTI Information Technology Surveys.
Notes: a. Includes only those technologies that appeared on both surveys; b. CD ROM drives are now standard features on nearly all new PCs. Therefore, CD ROM is no longer an innovative technology, except in applications such as CD ROM players or juke boxes that contain large volumes of textual materials or CD rewritable (RW) drives. c. The question was reworded for 1997 survey and asked % of employees connected to email: 48.4% said 1-10%, 17% said 11-50%, 8.3% said over 50%, 26.4 said none; d. The 1997 adoption rates mean that e-mail, LANs and portables can no longer be considered leading edge technologies; e. the 1993 survey asked about "portable"computers and the 1997 survey asked about laptops; f. 1993 survey asked about smart-coded toll booths "and parking." NA means data not available.

Another example is the use of fiber optic cable. Some local governments have deployed fiber optic cable sparingly, to one or only a few governmental buildings. Their survey responses, however, place them in the same category as local governments that have installed fiber optic cable extensively. Finally, one of the cities initially selected as a case study site was dropped after the initial site visit. This was because it had in place only a few of the technologies that had been indicated during the screening.

Local governments are adopting some leading-edge ITs fairly rapidly. This has certainly been true of LANs, which has been adopted by well over a majority of cities (increasing from 48 to 69 percent from 1993 to 1997) and e-government (increasing from 40 percent to 83.7 percent from 1997 to 2000). Yet they are not adopting others quite as rapidly (e.g., AFIS and long-range IT planning).

Another observation that can be made from these data is that surveys may or may not be good predictors of actual adoption rates. The cities were asked in 1993 if they were considering adopting these technologies. In only a few cases was there a close relationship between the percent of cities considering a technology and the actual rate of adoption as reported in the 1997 survey. For example, there was virtually no increase in the adoption of AFIS and CD ROM. The actual adoption rate in 1997 eclipsed by nearly 40 percent the combined and considering rates in the 1993 survey. The actual adoption of GIS increased a respectable 11 percent, but not the 42 percent that "were considering." The 1993 survey responses more or less accurately predicted the adoption rates of fiber optic cable, portable computers, smart toll booths, video arraignment, and virtual reality. (See Table 6.)

Finally, there is a direct relationship between local government size (population) and adoption of leading-edge information technologies. For each of the leading-edge information technologies in the 1997 ICMA survey, large cities were more likely than medium-sized or small cities to have adopted (Table 7). Indeed, for some leading-edge information technologies, such as AFIS, what constitutes full adoption among local governments may be achieved when all large cities and a sizeable fraction (say, 80 to 90 percent) of medium-sized cities have adopted. This is because today AFIS technology is simply too costly for small local governments——unless they are able to become remote users of regional or state AFIS systems.

As Norris and Campillo (in progress) and Holden, Norris, and Fletcher (forthcoming) have found, other local government demographic variables are also related to the adoption of leading-edge ITs. These variables typically (but not always) include type of government (more cities than counties); form of government (more city manager than mayor-council cities and more county administrator or county-elected executive governments than traditional county commissioner forms); region (more governments in the West than other regions); and metropolitan status (more central cities and counties than suburban or independent).[6]

LEADING-EDGE TECHNOLOGIES

The two ICMA/PTI surveys and the UMBC case studies have produced different lists of leading-edge information technologies which could cause confusion. Consequently, in this chapter I provide a comprehensive list of information technologies that in the early years of the 21st century could be considered leading edge among American local governments (Table 8). Over

Table 7. Adoption of Leading-Edge Information Technologies by City Size, 1997

	Small City		Medium City		Large City		Total	
Technology	No.	%	No.	%	No.	%	No.	%
AFIS	148	5.0	121	17.5	23	56.1	292	7.9
CD ROM	352	12.0	292	42.3	30	73.2	674	18.4
Direct Broadcast Satellite	44	1.5	41	5.9	3	7.3	88	2.4
Fax-back/Reply Service	391	13.3	127	18.4	15	36.6	533	14.5
Fiber Optics	257	8.7	330	47.8	35	85.4	622	16.9
GIS	618	21.0	400	57.9	35	85.4	1053	28.7
GPS	145	4.9	123	17.8	14	34.1	282	7.7
Interactive Teleconferencing	58	2.0	35	5.1	6	14.6	99	2.7
Intranet Server	229	7.8	138	20.0	26	63.4	393	10.7
Kiosk	42	1.4	41	5.9	10	24.4	93	2.5
Laptops (Use)	1239	42.1	602	87.1	40	97.6	1881	51.2
Local Area Networks	1901	64.6	626	90.6	39	95.1	2566	69.9
Long Range IT Plan	571	19.4	386	55.9	29	70.7	986	26.8
Personal Digital Assistance [a]	43	1.5	43	6.2	9	22.0	95	2.6
Satellite Imagery/Data	39	1.3	33	4.8	5	12.2	77	2.1
Smart-coded Toll Booths	11	.4	6	.9	1	2.4	18	.5
Video Arraignment	48	1.6	50	7.2	11	26.8	109	3.0
Virtual Reality Training	29	1.0	22	3.2	3	7.3	54	1.5
Wireless Services (Mobile radios and cellular phones)	1315	44.7	463	67.0	39	95.1	1817	49.5
WWW Site on Internet	880	29.9	460	66.6	37	90.2	1377	37.5

Source: 1997 ICMA/PTI Information Technology Survey.
Note: a. A misprint in the survey; should be "Assistant." Percentages are of total small, medium or large cities (i.e., AFIS has been adopted by 5.0 percent of small, 17.5 percent of medium, 56.1 percent of large cities, and 7.9 percent of all cities).

time, this list will lose its validity. Some of the technologies on it will reach the point of adoption beyond which they can any longer be considered on the leading edge of local government innovation, and other, more innovative, technologies will enter the marketplace.

In order to develop a list of leading-edge ITs, circa 2002 (Table 8), I began with actual adoption data from the 1997 ICMA/PTI survey, just five years previous

(Table 5). I dropped all ITs that had achieved 50 percent or greater adoption and eliminated yet others for additional reasons. For example, evidence from the UMBC case studied indicated that the use of fiber optic cable is becoming so widespread that this technology is probably no longer on the leading edge of local government IT innovation. Smart-coded toll booths and virtual reality have such narrow application as not to achieve widespread application any time soon. Video arraignment is applicable only in governments that have a judicial function and, among those, principally where distance is a factor in producing suspects for face-to-face arraignment, thus limiting the applicability of this technology. As I note below, both AFIS and GIS, although for somewhat different reasons, are not likely to be adopted by a large fraction of local governments in the foreseeable future. However, they are now tested and proven and are thus no longer leading-edge ITs. Finally, although survey and case study data (e.g., Norris, 1999; Cohen & Eimecke, 2001; Norris, Fletcher, & Holden, 2001) show that local governments do not engage in strategic or long-range IT planning, this sort of planning itself is well known and frequently enough practiced to no longer count as a leading-edge technology. Other ITs that in 2002 can no longer be considered leading-edge ITs include bar code technology, computer-based training, fax modems and servers, hand-held computers and PDAs, interactive voice response systems, Internet access and use, intranets, mobile data terminals, scanners, and WANs. This is because these are proven technologies that are in widespread use in government or businesses–even if relatively smaller numbers of local governments have adopted them. A different case must be made for removing public access information technologies (e.g., ATMs, BBS, Kiosks, public access terminals) from the list of

Table 8. Leading Edge Municipal Information Technologies, Circa 2002

Electronic Government (deployments that are integrated and transactional)
Electronic data interchange
Global positioning
Multi-media
Optical disk storage
Remote sensing data
Traffic control systems (automated)
Vehicle locator systems (automated)
Voice date, video applications (integrated)

leading-edge information technologies that I developed for an earlier version of this chapter (Norris, 1999). These technologies have largely, although not exclusively, been supplanted by local government e-government applications through the WWW.

Finally, it is important to note that no surveys have been conducted since 1997 to examine the adoption rates of innovative or leading-edge ITs in local governments. Thus, Table 8 is based at least in part on informed guesswork. Further studies of IT in local government are needed to ascertain whether this guesswork has correctly identified the current leading -edge ITs among local governments.

BREADTH AND DEPTH OF INFORMATION TECHNOLOGY PENETRATION

The surveys and case studies reported herein permit discussion of both the breadth and depth of penetration of IT in American local governments. Not only are most local governments computerized, but computers are used in most of the principal functions of local government. The 1993 ICMA survey found that nearly all of the routine administrative and housekeeping functions of local governments were automated. These included such functions as word processing, budget development, budget analysis, database analysis, and use of spreadsheets, and include automation in departments such as finance, utilities, personnel, law enforcement, public works, and governmental administration. In all of these cases, over 50 percent of cities reported automation with either PCs or central computer systems (Kraemer and Norris, 1994). (Unfortunately, the 1997 survey did not contain a comparable set of questions, and no general IT surveys have been conducted since 1997. Hence, comparisons over time of the penetration of ITs in various functional areas of local government are not possible.)

As noted above, e-government has penetrated more than eight in 10 American local governments. However, there is a wide range of e-government deployments– from those that are relatively primitive and consist essentially of one-way information provision (government to citizen) to those that are relatively sophisticated and provide for both horizontal (across a governmental unit) and vertical (among levels of government) integration and enable users to execute online transactions (e.g., pay bills and taxes). For the most part today, local government websites tend to be found on the lower end of the sophistication continuum. [For two useful models of the e-government continuum, see; Hiller and Belanger (2001) and Layne and Lee (2001).]

Findings that show a broad array of municipal functions automated among a large fraction of local governments speak to *breadth* of penetration. In addition, within each of these functional areas, a large number of activities can be automated. This indicates *depth* of penetration. For example, in the area of finance, it is not unusual for even smaller local governments to have fully integrated, automated financial management systems that include modules for such activities as budget preparation, budgetary analysis, budgetary accounting, payroll, purchasing, accounts payable, accounts receivable, and other related functions, all of which operate using a standard chart of accounts and a single general ledger. Similar computerized functionality can be found in a myriad of other areas of local government. Both breadth and depth of computing are produced by such systems.

To date, however, breadth and depth of penetration have occurred largely, although not exclusively, for *general governmental functions* in US local governments. The opposite is the case in terms of leading-edge technologies. That is, most leading-edge information technologies have not yet penetrated local governmental operations either broadly or deeply. This is, in part, a matter of definition. If, to qualify as leading edge, a technology cannot have been adopted by more than half of the potential adopting population, it follows that the technology cannot have penetrated broadly into that population.

However, it is also possible that a leading-edge IT may have penetrated deeply into at least some of the units that have adopted it. Here, evidence from the UMBC case studies is helpful. For example, the court clerk's office in Jacksonville, FL, had implemented a document imaging system that captures, scans, indexes, and stores all documents that enter the court. Thus, this technology has penetrated the clerk's operation completely. It has also become routinized and institutionalized within that office. However, the adoption of this leading-edge IT was limited to the clerk's office, and it had not penetrated other departments within the Jacksonville city government. Additional examples might include such technologies as mobile data terminals in police cars and AFIS systems. They have penetrated deeply within adopting (usually police) departments and have become institutionalized. However, they are rarely used by other departments. For AFIS, this is as one might expect, due to its limitation to law enforcement uses. However, mobile data terminals have application elsewhere–e.g., virtually any field services operation.

Regardless of adoption rates, depth of penetration does not seem to be the case with most of the leading-edge ITs. This is, in part, because the technologies are relatively new in municipal organizations, and many are not fully developed or deployed. This is particularly true, as indicated earlier, of many GIS systems. They tend to be not fully developed GIS systems; and while perhaps used extensively within adopting departments (e.g., planning and engineering), they are not widely deployed across departments in local governments.

Depth of penetration appears to occur incrementally for leading-edge information technologies. In part, this is because these are more complex systems, and they require considerable time, funding, and effort to become fully developed and deployed. As this occurs, these technologies also are more likely to become institutionalized within local governments. At the point of institutionalization, their use becomes more or less routine by appropriate classes of end users. It is probably fair to say that at this point, these technologies are accepted and nearly taken for granted by their users. Other factors militating against deeper penetration include lack of resources (money and staff) to support the technologies and lack of interdepartmental cooperation.

The greatest payoffs from leading-edge information technologies will occur after they are institutionalized in local governments. Again, examples from the UMBC case studies may prove illustrative. Take a fairly simple example like the use of mobile data terminals in parking enforcement vehicles in Denver, CO. Parking enforcement staff in Denver used these terminals to query via satellite a remote, commercially owned database system containing information about vehicles with overdue parking tickets. Information obtained from the query tells parking enforcement personnel which vehicles should receive the famous "Denver boot." This system increased accuracy, and 25 percent more vehicles were booted by the same number of personnel in the same amount of time with mobile data terminals than without. This increase has direct revenue implications for the city.

The converse of this example is GIS. GIS systems are, perhaps, the most complex and resource-intensive leading-edge IT in local government today. Nearly every expert in the field (and, of course, nearly every GIS vendor) contends that, ultimately, GIS will provide dramatic pay-offs to local governments. Except in rare instances, these pay-offs are not yet occurring. This is because GIS systems, in many if not most local governments that claim to have them, are not fully developed, are not widely deployed and used, and certainly are not institutionalized. Hence, local governments are investing substantial amounts of scarce resources to implement GIS systems, hoping that institutionalization will produce pay-offs sufficient to justify their costs. Indeed, this is an issue that should be the subject of future research: are GIS systems fully developed and deployed; have they produced expected pay-offs; and what are the factors associated with both full development and deployment and pay-offs?

WHY ADOPT LEADING EDGE INFORMATION TECHNOLOGIES?

Something must be driving local governments to adopt leading-edge information technologies. It cannot be just an effort to "keep up with the Joneses." Or can it? Clearly, local governments are not unaware or unaffected by the behavior of their primary reference group–other local governments. Earlier research into the diffusion of innovations among state and local governments has shown that policies and practices started by one or a few local governments can and often do spread to others (Walker, 1969; Bingham, 1976).

The typical pattern of adoption of innovations over time for all classes of adopters–and this is certainly true for local government adoption of IT—resembles an S curve. That is, relatively few units adopt an innovation in its early stages. As the innovation becomes more well known and accepted within a class of adopters (perhaps because of its effectiveness or because its benefit-costs ratio becomes clearer), the pace of adoption accelerates. Then, as the vast majority of potential adopters have adopted the innovation, the pace of adoption slows. Hence the resemblance to an S curve (see Rogers, 1983).

A case in point is the PC. In 1982, six years after the beginning of the PC revolution and one year after the introduction of the IBM PC, ICMA conducted a survey of the adoption of PCs in US cities. The survey found that only 13 percent of cities had PCs, although 35 percent said that they planned to purchase one (Norris & Webb, 1983). A 1983 survey of small local governments (counties under 100,000 and cities between 2,500 and 50,000) in the Great Plains and Midwest found that 22 percent had PCs (Norris, 1984).

Compare this with later surveys that found that nearly all cities have PCs. The 1993 ICMA survey found that overall 92 percent of cities had PCs. This included 100 percent of large cities, 94 percent of medium-sized cities, and 91 percent of small cities. The 1997 survey, although employing different questions, found that 87 percent of cities used IBM PCs; 51 percent used laptops; 11 percent used Apple computers; and 49 percent used workstations. The pattern of larger cities exhibiting higher rates of adoption was present in the 1997 survey as well.

These data show that in the period between the early 1980s and the mid 1990s, the adoption of PCs by municipal governments followed the typical S-curve pattern. Adoption of PCs increased from just over one in ten to greater than nine in ten cities in this period. The data also show that with nearly full adoption, the adoption rate (as indicated by the percent of additional governmental units adopting PCs) has slowed considerably.

The evidence for e-government is even more dramatic. In about five years, local government adoption of e-government rose from 8.7 percent (1995) to 83.7 percent (2000). By this writing, nearly all local governments (except for the smallest ones) are expected to have adopted e-government.

Adoption rates, however, do not reveal much about the reasons that local governments adopt leading-edge information technologies. Data from the UMBC case studies and a review of literature in the field reveal two principal categories of reasons that local governments adopt leading-edge information technologies (see also Demeter, 2001). They are general reasons and reasons that are specific to functions and activities. General reasons are oft-cited reasons that include state and local government users' and officials' expectations or hopes concerning the outcomes of computer use. They include such things as improving efficiency, effectiveness, and accuracy; saving money; increasing revenue; reducing the amount of time required to complete tasks; and reducing staff. Although these reasons are often stated quite generally, they nevertheless carry meaning. This is another way of saying that local governments do not adopt leading-edge information technologies frivolously.

Additionally, even though the reasons may ring of generality, they can also be quite context specific. For example, in Charlotte, NC, officials reported that because of downsizing, city departments were losing personnel. In Jacksonville, FL, city departments found it difficult to get additional personnel positions approved. Hence, both cities used IT to do the work that would otherwise require additional staff. As one respondent in Charlotte put it: "In a time of downsizing, we underspend our general fund budget. IT helps with this. We can lose positions and make up for it with IT."

Also in Jacksonville, the electric utility reported that providing better service was a particularly salient reason for adopting the use of laptop computers in service vehicles. The utility was committed to providing same-day power restoration after a customer whose electricity had been turned off paid his or her bill. With laptops in the field that were linked via radio to the central computer system, technicians had up-to-date information about shut-offs and turn-ons literally at their fingertips.

Function- or activity-specific reasons, as might be expected, are tied to specific functions, and they can be as numerous and varied as the functions that are automated. Here are a few examples. Denver, CO, used its GIS system to address equity concerns and also to increase revenue generation from storm-water billing. In Denver, the city government bills property owners for the amount of impervious surface (which produces storm-water runoff that the city must manage) on their property. Manual methods of estimating the amounts of impervious surface had led to concerns about the fairness of the billing system. Using a GIS improved the accuracy of determining the amount of impervious surface. It also enabled the city to produce twice as much revenue from storm-water billing in the first full year of use of the GIS than previously ($10 million versus $5 million).

Denver also used video arraignment of suspected criminals. This system was implemented because of both cost and safety considerations. The jail is located 20 miles from the courts. This had meant that safety officers had to transport prisoners to and from the courts and guard them. Two-way, interactive video arraignment reduced the need for transport and simplified the task of guarding the prisoners. It also reduced the risk of harm to the safety officers.

New Orleans, LA, had a fully staffed, in-house computer-based training facility that provides training to all city staff. New Orleans estimated that this facility has saved the city considerable money. On average, it cost $31.00 per pupil in-house versus $160.00 from a local university for the same training.

These are just a few of numerous examples from the UMBC case studies that confirm that local governments have both general and specific reasons for adopting leading-edge information technologies. Although these governments do not often conduct elaborate analyses to justify the adoption of the technologies, they nevertheless approach them quite seriously and fully expect that the technologies will perform up to the local governments' expectations. Whether they do is addressed in the following section on the impacts of leading-edge information technologies.

In addition to reasons provided by managers and end users of leading-edge information technologies, several factors in city government tend to operate to either facilitate or hinder adoption.[7] Among the most important facilitating factors, as identified in the UMBC case studies were:

- *Support of top officials*—usually one or more of the following: the mayor, city manager, IT director, key department heads, strategically placed (and technologically "smart") end users.
- *Pressure from end users*—especially found in the more technically inclined departments, such as engineering, planning, and transportation. These are also departments in which personnel are likely to have been trained for their profession using computers and who use computers in their daily activities.
- *Positive organizational climate*—such things as support for innovation from top officials, support for risk-taking, the adoption of formal plans for adopting technology, a history of innovativeness, and managerial proficiency.
- *Information technology champion*—often this was the IT director, but it easily could be a mayor, city manager, or a key department head. Without a champion, IT did not receive the type of support that enabled cities to be on the leading edge of innovation.
- *Slack budgetary resources*—having money makes buying and supporting innovative IT much easier than not having money. Additionally, "special" sources of revenue were especially helpful (e.g., funds from the rate structure for utility departments and funds from RICO type statutes for police departments).[8]
- *Skilled personnel*—this speaks to the importance of having well-trained, capable technical personnel to assist with planning, acquiring, implementing, and providing on-going support for leading-edge information technologies.

- *Central information technology department*—cities with the most effective and most "user-friendly" central IT departments were clearly the most innovative.

The case studies also found that there were several factors in city government that operated to hinder the adoption of leading-edge information technologies. These included:

- *Lack of understanding of information technology by top officials*—this was often noted by respondents as they compared different city officials or administrations and noted which were or were not computer literate. In one city, when a new administration came into office, the mayor's staff wrestled not with ensconcing themselves in the best offices, but in finding outlets to connect their computers. According to respondents in this city, this signaled the arrival of top officials who understood IT and for whom it would be a priority.
- *Lack of budgetary resources*—several cities complained that tight budgets meant that they could not do enough in the area of IT. Having surplus funds was certainly better than not. (However, it was also clear that even in cities with tight budgets, if the top officials and administrators supported IT, resources would be made available.)

Table 9. Barriers to E-Government

Which, if any, of the following barriers to e-government initiatives has your local government encountered?

	No.	Percent
Lack of technology/web staff	1,031	54.8
Lack of financial resources	840	44.7
Lack of technology/web expertise	723	38.4
Issues regarding security	652	34.7
Need to upgrade technology (PCs, networks, etc.)	525	27.9
Lack of information about e-government applications	438	23.3
Issues regarding privacy	429	22.8
Issues relating to convenience fees for on-line transactions	409	21.7
Lack of support from elected officials	192	10.2

Source: ICMA/PTI 2000 Electronic Government Survey.

- *Strategically placed individuals*—just as key individuals could be facilitators of the adoption of leading-edge information technologies, strategically placed persons could also hinder it. These persons could include: department heads, an occasional IT director, key end users, and, in several cities, the budget office came in for particular criticism for "blocking" adoption of IT.
- *Central information technology department*—just as the central IT department could be a key facilitator, so it could also be seen as a negative factor in innovation. In a few of the cities, some respondents felt the department either remained a roadblock to innovation or had only recently "got religion." Getting religion generally meant that the department had abandoned what might be called the central DP shop mentality and had embraced the PC age and the age of decentralized computing.
- *Lack of interdepartmental coordination*—this was clearest in those cities which had the strongest tradition of departmental autonomy. And it showed up most obviously in GIS systems, with various departments developing their own (often incompatible) GIS systems.

The 2000 ICMA/PTI e-government survey also inquired into barriers to adopting this technology (Table 9). Among the most important barriers, receiving responses from between one-third and one-half of respondents, were lack of technology/web staff (54.8 percent); lack of financial resources (44.7 percent); lack of technology/Web expertise (38.4 percent); and issues regarding security (34.7 percent).

IMPACTS OF ADOPTION

Having discussed why local governments adopt leading-edge information technologies, is it fair to ask whether local governments' expectations (or, perhaps, hopes) concerning the outcomes of using these technologies are met? Local governments in general and the case study local governments in particular rarely perform formal studies, especially cost-benefit analyses, of the adoption of information technologies. Indeed, the absence of cost justifications for such technologies was a complaint made by many a local government budget office. (On the other hand, line departments complain that budget offices made it far too difficult to acquire IT by requiring cost justifications.) In any event, the absence of such studies means that analysis of the results of adopting leading-edge information technologies have been and will largely be based on the perceptions of managers and end users. Perceptions, however, especially those of managers and key end users, are valuable because they are based on what these individuals observe and experience concerning the performance of information technologies (see, for example, Northrop et al., 1990).

The evidence from a variety of studies over the past two decades of research on IT in local government points unambiguously to the following conclusion: the impacts of IT in local governments are mostly positive, although the technologies are not without problems. Moreover, most local governmental officials and end users are quite satisfied with these technologies and believe that they have produced mainly positive results. (See, among others, Kling, 1978; Kraemer, Dutton, & Northrop, 1981; Danziger & Kraemer, 1986; Norris, 1989; Northrop et al., 1990; Kraemer & Norris, 1994; Norris & Kraemer, 1996; Kraemer & Dedrick, 1997.)

Among other things, these studies have found that IT generally enhances rather than diminishes jobs and makes work easier and more enjoyable. At the same time, however, the technology can increase the pressure on employees and produce employee frustration. IT also improves efficiency and accuracy, provides more and better information for decision makers, enables employees to provide better service to citizens, and improves speed and timeliness. Moreover, positive impacts are reported by managers and end users alike and also are reported regardless of gender or job category (Norris, 1992).

The rhetoric surrounding e-government suggests that it delivers mostly, if not exclusively, positive impacts (Moon, 2002; Holden, Norris, & Fletcher, forthcoming; National Research Council, 2001). A recent report from the National Research Council (2001, p. 3) stated that e-government is expected to produce the following benefits:

- More accessible government information;
- Faster, smoother transactions with government agencies;
- Enhanced ubiquity of access to information and transactions;
- Greater effectiveness in meeting the needs of specific groups of users;
- Increased participation in government by all people, fostering a more informed and engaged citizenry;
- Greater ability to meet expectations for advances in government-unique areas; and
- More efficient internal government operations.

Yet, the use of IT is not a one-sided coin. Among problems with information technologies, the following reported in the 1997 ICMA survey are fairly typical (Table 10). The major problems encountered by the reporting jurisdictions included personnel training, underutilization of computer capacity, resistance to change, resistance to use, and vendor service—all reported by over a quarter of respondents. A similar question on the 1993 survey produced similar results for both central systems and PCs (Norris & Kraemer, 1996). Among other things, these data suggest that local governments believe that they do not do a good job training their employees to use IT. Additionally, and perhaps as a result of inadequate training, nearly a third of local governments believe that employees resist change, resist use, and do not use computers to their capacity. Finally, vendor service was reported by over a quarter of local governments as a problem. In 1993, 26 percent of central system local governments and 24 percent of PC—only local governments said that vendor service was a problem (Norris & Kraemer, 1996).

The UMBC case studies produced similar results. When asked about the impacts of leading-edge information technologies, elected officials, managers, and end users were nearly unanimous in their view that these technologies had produced mainly positive results–and positive results of the sort that have previously been reported in the literature. However, there was also somewhat of a "wait and see" attitude. That is, respondents in these local governments felt that the leading-edge information technologies had not yet lived up to their potential. This was because,

Table 10. Problems with Computers

Problem	Percent
Personnel Training	46.3
Under utilization of computer capacity	37.2
Resistance to organizational change	31.0
Resistance to use	30.2
Vendor service	27.4
Equipment performance	19.0
Software availability	16.1
Integration of micros with mainframe/mini-computers	15.0
Equipment reliability	14.6
Equipment and quality	10.4

Source: 1997 ICMA/PTI Information Technology Survey.

for the most part, the technologies had not been fully developed and deployed within the local governments.

One common negative impact that was reported by several of the case study cities concerned the start-up or initial implementation of leading-edge information technologies. Start-up problems included technical difficulties with hardware and software and difficulties managing implementation. Here, respondents reported that implementation was always more difficult and took longer than initially estimated and was more frustrating. However, they also reported that after implementation was completed and a technology was in routine use that its impacts were nearly always positive.

The case study cities provided numerous examples of positive impacts.[9] Here are three that are typical. The electric utility in Jacksonville, FL, reported a 200 percent improvement in the productivity of technicians' handling of "trouble" calls in the field after they were equipped with laptop computers linked via radio to the central computer system. In Philadelphia, PA, the implementation of an automated mugshot system saved the city $600,000 annually. The finance department in Overland Park, KS, used the GIS system to identify cable TV customers located within the city on whom the cable company was not paying the city's franchise tax. This resulted in a net additional income to the city of $30,000 per year.

Evidence from the field also suggests that e-government is not quite the panacea that the rhetoric would suggest. Although little research has yet been conducted on the impacts of e-government, that which is available suggests caution in attributing impacts. For example, the ICMA/PTI *2000 E-government Survey* found that one in five local governments (21.9 percent) felt that e-government

Table 11. Perceived Impacts

How has e-government changed your local government?

	No.	Percent
Increased demands on staff	344	21.9
Changed role of staff	323	20.5
Business processes are being re-engineered	283	18.0
Business processes are more efficient	214	13.6
Reduced time demands on staff	135	8.6
Reduced administrative costs	79	5.0
Reduced number of staff	11	0.7
Increased non tax based revenues	10	0.6

Source: ICMA/PTI 2000 Electronic Government Survey.

increased demands on staff; 20.5 percent said that it changed the role of staff; while only 8.6 percent said that it reduced time demands on staff; 0.7 percent said that it reduced the number of staff; and 0.6 percent said that it increased non-tax-based revenues (Table 11).

FUTURE TRENDS

In part because local governments believe that leading-edge information technologies produce largely positive impacts, one obvious future trend will be that more local governments will adopt these technologies. Additionally, more leading-edge technologies will be adopted by local governments. In other words, future surveys of IT adoption among local governments will find that a larger fraction of local governments have adopted leading-edge technologies and that a larger number of such technologies have been adopted. These two trends are nearly inescapable. They clearly have been the case with respect to IT in local government in the US for at least the past five decades: more local governments have adopted IT with more technologies being adopted each successive year (and, each year, the sophistication of the technology increases.) Moreover, there is no evidence to suggest that these trends will stop. For the moment, Table 8 provides a handy guide to the most likely leading-edge information technologies that local governments will be adopting in the near future. However, the prudent reader will understand that this list is likely to have a short shelf-life.

A third trend is that leading-edge information technologies will continue to penetrate local governments more deeply and, as deeper penetration occurs, so will greater pay-offs from use. As more sophisticated technologies like e-government, GIS and others become more well developed and deployed within local governments, and as their use grows (especially as it grows across department and functional lines), they will become institutionalized and routinized. As this occurs, so too will a greater occurrence of positive impacts.

A fourth trend is that as new and more sophisticated information technologies are adopted by local governments, integration of and support for them will become even more critical than is currently the case. One of the findings from the case studies is that "interoperability" is desired by nearly all local governments with extensive IT operations. In essence, interoperability means that any user can sit at any workstation and access any software or database (to which he or she has authorization) in the organization—regardless of platforms, operating systems, or physical location in the organization. Today, however, because of the multiple and often incompatible platforms and operating systems that are often found in local governments, interoperability is an elusive goal. As local governments add even more information technologies that themselves are quite sophisticated, there is little reason to think that this situation will change. Indeed, achieving interoperability may be the one of the biggest challenges local governments will face in the next several years in their quest for the most effective and efficient use of IT.

Fifth, local governments will find that the relatively new information technology known as electronic government is not a low-cost alternative to traditional government service delivery. It may be an efficient and effective way to deliver information and services. However, e-government is and, for the foreseeable future, will continue to be an add-on to traditional government offerings. Constituents will increasingly use e-government, but they will also continue to demand services with the human touch (e.g., face-to-face as well as telephone services). This will mean that local governments will need to devote additional resources (especially financial resources and staff) to develop, maintain, support, and expand their e-government offerings and that these resources will not be offset by either direct dollar savings or cost avoidance (e.g., through future reductions of personnel).

Finally, although more of a finding than a trend, population as a measure of local government size will remain a key determinant in the number and type of leading-edge information technologies adopted. While the overall extent of adoption of leading-edge information technologies among local governments can be expected to increase, the greatest extent of adoption will be among larger jurisdictions. Larger local governments will adopt more leading-edge information technologies than their smaller cousins. Larger local governments will also adopt the more sophisticated and advanced information technologies, as well. This will be due, in part, to the relatively greater budgetary resources possessed by larger local governments. In part, it is due to need—a city of half a million has a far greater need for an AFIS than a city of 5,000. In part, it is due to the greater institutional ability of larger local governments, which are more likely than smaller ones to have central IT departments, to plan, implement, and support advanced information technologies (Norris & Kraemer, 1996). And, as noted earlier, other demographic variables can be expected to continue to be associated with the adoption of leading-edge ITs, including type and form of government, region of the country, and metropolitan status.

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ENDNOTES

[1] As I will explain later, the adoption of e-government alone is no longer sufficient to be considered innovative since over 83 percent of American local governments have sites on the WWW. The important innovativeness characteristic for e-government is the extent of WWW site sophistication.

[2] This city had just completed an extensive long range planning process and did not want to "be studied" again quite so soon.

[3] The study also endeavored to provide balance in its selection of cities using the following additional criteria: region of the country, population and form of government. Cities in the southeast were over-sampled somewhat, in part to meet an objective of one of the project's funders. No cities smaller than 100,000 in population were included because the literature shows a direct relationship between adoption of IT and city population. Finally, no cities over 1.5 million were included because of the amount of effort and time that would be required to conduct a case study in such a city.

[4] This adoption rate may be artificially inflated due to question wording. The question included radios and cellular phones to define wireless services. And, cities using radios but not cellular phones may have responded.

[5] Unfortunately, this survey received less than a 14 percent response rate. Therefore, responses should be viewed cautiously.

[6] These variables are based on the standard ICMA demographic categories in its survey work. See, for example, *1999 Municipal Yearbook* (Washington, DC: International City/County Management Association, 1999), pp. 10-11.

[7] Most of these factors are not unique to the UMBC case studies, and have been observed repeatedly in the literatures on IT in local governments and diffusion of innovations.

[8] The RICO, or anti-racketeering, statute enables police departments to retain some or all of the funds derived from the sale of property in drug arrests.

[9] They provided very few examples of negative impacts even though researchers probed for them.

Chapter VIII

Information Technology as a Facilitator of Results-Based Management in Government

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ABSTRACT

The most widely accepted normative model of "good" public management is often called results-based management. It encourages planning and target setting to make the organization more proactive; an emphasis on outcomes to make the organization better focused on its mission; quick performance feedback to make the organization more responsive; and continuous process improvements to make the organization better able to serve its clients. These changes are possible only with supporting information technology. This chapter discusses ways that IT, including GIS, EIS, and intranets, can support the new management model. However, IT can increase management effectiveness only if its role has been carefully designed. Before implementing major IT changes, top public managers must begin by determining such policy issues as what information would best guide upcoming major decisions; what balance the agency wishes between internal information accessibility versus security; and how best to balance frontline worker empowerment versus the need for organizational uniformity.

INTRODUCTION

The role of information technology in government management has constantly evolved over the years. This evolution has generally been driven by changes in IT, as both software and hardware have rapidly improved. However IT's management role has recently been changing more rapidly, and this time it is because public management, at least as much as IT, has been changing. This chapter will discuss some of the ramifications of this new role for IT within public management. In the first of three sections, it will briefly describe the new normative model of best public management practices. Second, it will look at ways that IT can advance this new model. Third and finally, it will examine some policy issues that must be confronted when incorporating IT into public management systems.

THE NEW MODEL OF PUBLIC MANAGEMENT

The Changing Definition of "Good" Public Management

During the past decade, consultants, texts, academics, and professional societies have all combined to change the accepted definition of "good" public management. Twenty years ago, public managers who listened to their workers, kept their operations moving smoothly, and calmly handled occasional crises would often be considered outstanding managers by peers and by outsiders. Today such managers would likely be viewed as competent but disappointingly passive. To be seen as outstanding, today's managers must proactively move their agencies to higher levels of performance each year. The current normative model of public management calls upon managers to continuously improve their agency's performance by scanning their environment purposively and then using the resulting information to set agency targets for improved results, including improved customer satisfaction. The new model then suggests ways of flattening the organizational structure, streamlining its processes, and speeding up its feedback systems in order to help produce these continuously improving results.[1]

Confusingly, this single new model has been given at least three different names: results-based management, strategic management, and performance management. We will use the term "results-based management" in this chapter. (Adding to the confusion, a fourth term—New Public Management, or NPM— is also sometimes treated as a synonym. However, NPM is a broader concept that includes results-based management but then also adds a strong market emphasis, calling for more public entrepreneurship and increased privatization. NPM's market-oriented policy prescriptions lie outside this chapter's focus on internal management improvements, and we will not consider NPM further.)

Governmental results-based management combines several streams of management changes that developed separately over a decade, primarily in the business world. Total Quality Management (TQM) was first. In the 1980s, as Japan's economic growth was at its peak, US and European companies looked to learn from Japanese management and its use of TQM.[2] Major US corporations quickly adopted many TQM approaches, especially frontline worker empowerment, process benchmarking, and continuous measures of customer satisfaction. Reengineering, with its tools for process improvement, was implemented by many companies a few years later.[3] Government soon began to adopt modified versions of these business techniques and later added performance (outcome) measurement to the mix. By the start of this century, these tools had been combined and synthesized into a model of governmental best management practices that looked far different from those of twenty years earlier.

This governmental results-based model has achieved widespread acceptance. At the federal level, it was endorsed by the Clinton administration (under the rubric of "reinvention") as well as by the George W. Bush administration, and by Congress through the Government Performance and Results Act of 1993. The model is also widely accepted by city managers (Kearney, Feldman, & Scavo, 2000; Moon & de Leon, 2001) and has been promulgated by the major public managers' professional societies.[4] Actual governmental implementation substantially lagged the symbolic acceptance of these new models, but it too showed steady increases (Kettl, 2000; Thompson, 2000; Moon & de Leon, 2001; Brudney & Wright, 2002).

The Primary Characteristics of Results-Based Public Management

The differences between the older and newer models of good management can be summed up in three terms. The new model attempts to make public agencies more *proactive*, more *agile*, and more *results-oriented*. To produce these characteristics, an organization undertakes a number of steps. Four of the most important include:

- As part of its strategic planning process, the agency scans its environment to spot relevant trends (whether opportunities or threats) before they affect the agency.

- The agency proactively sets results-based targets, both long-range and short-range. Results, also called outcomes, are measurable effects on people outside the organization. For a school, the results (outcomes) might include increases in learning or in later earnings. For a police department, results could include increases in convictions, decreases in crimes, and greater feelings of safety. For a health department, results include fewer days lost to work, fewer days of hospitalization, and fewer deaths. Because customer satisfaction is always one important goal for any public agency, customer ratings are always among the results tracked.[5]
- The agency then gathers continuing information on how well it is reaching those outcome targets and takes remedial action if there are shortfalls.
- The agency attempts to increase customer satisfaction by offering quick, "one-stop shopping" that allows the client to receive coordinated services from one location and, in many cases, from one person. Such coordinated service delivery is promoted by empowering frontline workers to handle more of a customer's needs and by mechanisms for coordinating (and in some cases permanently cutting across) functional silos.

Empirical Evidence for the Efficacy of Results-Based Management

Both business and government managers have enthusiastically embraced many new management approaches over the past half-century. Some of these new management tools and approaches have left lasting imprints, but far more have quickly died and are remembered today only as fads (Light, 1997; Micklethwaite & Wooldridge, 1996). Does empirical evidence indicate that results-based management is more than another short-lived fad?

The record is promising but mixed, with strong evidence for the efficacy of some aspects of results-based management but slim evidence for other aspects. For example, there is as yet little evidence for the efficacy of strategic planning in the public sector, although private sector studies suggest that strategic planning can, under some circumstances, produce improvements (Miller & Cardinal, 1994; Boyne, 2001). There is good evidence that process improvement techniques drawn from reengineering and TQM sometimes produce positive changes in internal governmental activities, including fewer errors, lower costs, and shorter cycle times; however, their effect on outcomes is far less clear (Mani, 1995; Poister & Harris, 1996, 2000). The evidence is best, and the results most dramatic, for management approaches based on target setting and feedback. A large number of studies show that face-to-face goal setting and results tracking often produce major gains in organizational outcomes (Locke & Latham, 1990; Rogers & Hunter, 1992; O'Leary-Kelly, Martocchio, & Frink, 1994). An overall evaluation, then, might conclude that the efficacy of some aspects of results-based management is unclear but that many important components do have empirical backing.

The Rigorous Demands of Results-Based Management

Results-based management makes rigorous demands of government agencies. A results-oriented government agency proactively determines a long-range direction and then advances in that direction through a series of goals and objectives expressed in terms of desired results—i.e., specific, measurable outcomes expected—rather than activities. In order to pursue these outcomes nimbly, it avidly seeks and digests current information about changes in the environment, about its own progress toward outcomes, and about customer satisfaction. It ensures that it is able to act quickly upon this information by restructuring its operations so that its organizational structure is flatter, its frontline workers are more empowered, and its processes are streamlined to reduce cycle time and handoffs.

To meet the demanding expectations of this model, an agency requires a great deal of complex data—timely, complete information about both processes and outcomes. The model also requires that the organization have the ability to act promptly on that information. These requirements can be met only by agencies that take advantage of recent developments in information technology, and this management role for IT is the subject of the next section.

INFORMATION TECHNOLOGY AND RESULTS-BASED MANAGEMENT

IT in Public Agencies: The Historic Emphasis on Operations over Management

Management texts distinguish *operations* from *management*. Operations, usually carried out by frontline workers, are government's day-to-day activities, such as a teacher teaching fifth-grade students, a doctor treating patients, or a sanitation crew picking up garbage. Routine supporting services for these frontline activities, such as purchasing or inventory control, are also classified as operations.

Management, on the other hand, is the process of coordinating and directing many such operational activities to produce an effective agency.

Management has commonly been the mission of the middle and upper levels of organizational workers.[6] For a school district, for example, keeping the records of one student is a concern of operations. However, when the student records are aggregated and used to determine how one school has performed compared to another school (or compared to a target), the information is now a concern of management because this aggregated information can be used to direct the organization.

IT has historically been much more important for government operations—running the inventory reorder system, the accounting system, and the payroll system, or maintaining records for each client transaction—than it has been for government management. (This suggests that many of the governmental IT systems over the years that were termed *management information systems*—MIS—might more accurately have been termed *operations information systems*.) However, IT's management role is now rapidly expanding. Information systems are now better able to produce the timely information needed to set agency direction, to help determine whether the agency is moving in this direction, and to help direct remedial action if it is not.

Many of the streams that make up today's model of results-based management were created and developed with little concern for IT,[7] but most agencies have found that they can meet the demanding expectations of the model only if they incorporate IT at each step. We will look at IT's role by examining its impact on each management step that was discussed in the first section.

IT's Role in Scanning the Environment and Setting Long-Range Goals

As part of strategic planning, agencies scan the organizational environment to spot early trends ("opportunities and threats"), so they can move proactively. IT, in the form of data mining, can help agencies in such scanning by showing agencies relationships and trends that they never expected. At the federal level in particular, as Cahlink (2000) reports, data mining is often used for long-range planning. For example, "the Justice Department has used it to find crime patterns so it can focus its money and resources on the most pressing issues. The Veterans Affairs Department has used it to predict the demographic changes among its 3.6 million patients so it can prepare more accurate budgets. [And] the Internal Revenue Service uses the technology at its customer service center to track calls in order to pinpoint the most common customer needs." The IRS can then address these needs through its long-range plans.

Geographical information systems (GIS) also play an important role in strategic planning, especially for local governments. By using the GIS data to track physical and demographic changes block-by-block and neighborhood-by-neighborhood, a city or county gains the insights it needs to understand trends and to determine the best long-range approaches.

IT's Role in Promoting Agility Through Quicker Feedback

Results-based management emphasizes making the organization more nimble, so it can adjust quickly to change. An agency's agility is enhanced by the early warnings of outside changes provided by strategic planning and by the quick reaction times of empowered frontline workers. However, an agency's agility depends most of all on its ability to quickly secure current information about the agency's ongoing performance. Such real-time performance data ensures that good performance can be immediately reinforced and that performance shortfalls can be promptly remedied.

Very small public organizations will sometimes track and report performance measures using only simple spreadsheets to total and compare monthly figures. For most organizations, however, performance data is usually tied to more sophisticated information processing capacities that compile data from many different stations or offices and then report it in a timely manner. The recent increase in IT portability has also been an important advance in managerial feedback. One good example is provided by the management of a very large parks maintenance program:

> *For a decade, New York City's parks and recreation department sent inspectors into parks to rate the performance of its maintenance teams. The inspection crews compiled massive reports covering all 1,500 city parks. The task was so overwhelming that the report could only come out three times a year, and by the time it came out, the data was stale and too mountainous to be useful.*
>
> *Three years ago, the department overhauled the inspection program and bought four hand-held computers. The computers fit into the palm of one hand and show a menu of the twelve parks features, from lawn condition to graffiti, that inspectors rate as either acceptable or unacceptable. Inspectors enter information through a touch-screen keypad and can add additional comments through a handwriting feature. At the end of the day, the data is*

> *uploaded straight into the database that the department uses to churn out performance reports.*
>
> *. . . By speeding the data-collection process, the technology allowed . . . [the department] to move from voluminous triennial reports to biweekly performance reports on roughly 115 parks at a time. (Swope, 1998, p. 61)*

Because of new forms of IT, the top managers of the parks department had fresher, more usable data to establish accountability. The department became more agile, with far quicker remedial responses. The overall conditions of the parks rapidly improved, with the percentage of parks graded "acceptable" almost doubling from 44 to 83 percent (Swope, 1998).

IT's Role in Promoting a Focus on Overall Results

Geographic information systems (GIS) are a particularly useful managerial tool, because they allow managers to see overall patterns. Most large police departments, for example, now use GIS to display crime results district by district. Inspections departments, planning departments, fire departments, and other agencies also gather, analyze, and display their performance measures through GIS. New York's Comstat is the premier example of this approach. As one observer notes:

> *In police circles the tense and theatrical NYPD Comstat meetings are the stuff of legend. All the top cops pack into a "war room" around a large rectangular table. Colorful computer-generated maps flash up on a screen, showing recent crime trends and statistics. A precinct commander takes the hot seat, and questions start flying: "Why are robberies up in this neighborhood? What are you doing about it?"*
>
> *. . . [In all cities with similar systems,] geographic information systems and database technology bring the statistics to life. And commanders are held responsible for reducing crime in their areas. For many departments, this process— especially the accountability part—is nothing short of revolutionary. (Swope, 1999)*

As it developed, Comstat broadened the range of results it tracked. For example, citizen groups feared that too much attention to crime rates alone led to goal displacement, and so Comstat also began to hold commanders accountable for such outcomes as the number of citizen complaints about police behavior and similar measures of police civility. The resulting range of measures helps produce a good overall picture of performance.

Other cities have taken the same IT-enabled feedback model and applied it to all city services, not just police. Baltimore, for example, holds "citistat" agency meetings every two weeks, with "the projection screens awash with spreadsheets, graphs and maps, visual representations of how well each city agency is doing its job." Says the head of the Baltimore Parks and Recreation Department, "Citistat has redefined what our jobs are . . . We need to constantly evaluate what we're doing and see it makes a difference" (Swope, 2001).

Even when not tied to Comstat-like reviews, the pace of feedback has quickened in many organizations. In the past, agency personnel would often receive written summaries of their unit's performance measures infrequently, with quarterly reports most common. This undercut the rapid feedback that is one of the main advantages of performance measurement. Now many agencies post performance information on intranets, making weekly and even daily information available for decision making at all levels.

IT's Role in Coordinating and Streamlining Services to Provide One-Stop Shopping

Results-based management promotes one-stop shopping, which brings together all related services in one location. For example, a low-income client could receive help with housing, food stamps, income maintenance, health care, and job training from one location and possibly from just one case manager. One-stop shopping is usually advocated as a way of helping clients save time and avoid confusion, and these in fact are major benefits. But far more important, such cross-functional coordination can help government achieve its most important long-range program results, because attacks on any social problem—poverty, or crime, or substance dependency—are more likely to succeed if they are coordinated, rather than delivered piecemeal by different organizations at different times under different rules. Such a coordinated service system requires coordinated information streams. Integrated information systems, then, not only increase client satisfaction through one-stop shopping but, more importantly, increase the agency's ability to produce meaningful results.

Fostering Seamless Services Through IT-Driven Disintermediation

Information systems, particularly Internet-based systems, can also foster greater efficiency and quicker services through disintermediation—in plainer English, by eliminating the middle man or woman (Jallat & Capek, 2001). In the private sector, for example, online travel sites allow consumers to order tickets directly from airlines, eliminating the time, information loss, and cost of travel agents who once mediated between consumers and airlines. Disintermediation leads to greater efficiency because the service is provided with fewer handoffs (i.e., steps involving different actors).

In government, information systems provide a faster, more seamless experience for clients by enabling two types of organizational disintermediation: decreasing the number of handoffs to middle managers, and decreasing the number of handoffs to frontline information processors and advisors.[8] IT's potential to decrease layers of middle management has been widely discussed and analyzed. IT, particularly expert systems and online help lines, can take over some of the roles that middle managers once played as resident experts and coordinators for less-experienced frontline workers. Moreover, middle managers traditionally carried information from upper management to frontline workers; and now this role, too, is diminished because IT allows direct, immediate connections.

The type of disintermediation that raises the most complex management questions, though, is the potential elimination of many frontline client advisors. A generation ago, a job seeker at a government employment agency might well work entirely through a job counselor who would screen job opportunities and suggest ways of contacting potential employers. Now job seekers usually interact much less with such frontline advisors, because they are often quickly directed to Internet-based job listings which they screen on their own and then use to communicate directly with employers. Government has similarly used IT to eliminate many frontline advisors for such functions as helping government employees to invest their retirement funds or helping community college students choose and register for courses. This type of disintermediation is often termed coproduction, because it replaces the government intermediary with the efforts of the clients, who help coproduce their own results.

Such IT-driven efficiencies have many advantages, because they speed the process and give the client more direct control; but some agencies have discovered that their systems assumed too high a level of client information and self-confidence. Some clients are willing to give up speed and convenience in exchange for the advice and reassurance provided by human intermediaries. The IT-enhanced service systems that have proved most effective are those that are flexible enough to meet the needs of both the self-sufficient clients and the reassurance-seeking clients.

Summarizing IT As a Management Facilitator

Results-based management aspires to be proactive, agile, and results-oriented. IT in the form of data mining helps agencies proactively scan the environment; IT in the form of hand-held computers and flexible databases helps the agency agilely monitor and act; IT in the form of GIS and integrated information systems helps the agency focus on the overall results. At every step, IT provides capabilities that are crucial to results-based management.

POLICY ISSUES IN USING IT TO ADVANCE RESULTS-BASED MANAGEMENT

When managers first consider ways that they can use IT to facilitate results-based management, they must begin by making a series of decisions about where the balance should lie between costs and level of systems integration; between internal data accessibility and privacy concerns; between efficiency and political openness; and between frontline empowerment and organizational uniformity. This section will discuss each of these decisions in turn.

Balancing the Extent of System Integration with Costs

The ideal IT system for results-based management would integrate the information that is often now scattered among incompatible legacy systems, so the agency can gain a complete, overall view of its ongoing performance. Such a system is often called executive information system (EIS). An ideal EIS would be accessible to authorized users from any browser, and it would give managers immediate access to real-time feedback on how well they are progressing toward their process targets and their outcome targets. It would allow all performance information to be broken down by regional and functional subunits, displaying it graphically as well as numerically. It would allow managers to easily conduct "what if" scenarios to see how future changes would affect goal attainment. It would incorporate outside environmental information, as well as customer and client survey information. In short, an ideal management information system would provide all the information that managers would need in order to set short-term and long-term performance targets, to gather process and outcome information about progress toward those targets, and to conduct research on ways to perform better.

Many large government agencies have begun to take steps in this direction, but as Liang and Miranda (2001) point out, they commonly have moved only part-way, to enterprise resource planning (ERP) systems. ERP systems, they note, represent a major step up from the old, one-item-at-a-time legacy systems, but nonetheless basic ERP systems often "have done more to increase the efficiency of transaction processing than they have done to improve the strategic capabilities of managers and executives with enterprise-wide responsibilities" (p. 14). "The very data that executives need for strategic and tactical decision making often requires the combination of data from ERP and non-ERP application sources (e.g., cost accounting information, efficiency indicators, customer information, performance measures, historic data for forecasting") (p. 15). They note that many governments are now beginning to pursue the next level of IT that will allow ERP information to be combined with stand-alone systems, thus creating true executive information systems. For the most part, though, all but the very largest public agencies are many steps away from this ideal.

Looking well into the future, an ideal information system would move beyond an EIS for a single agency. One of the most important management trends of recent years is that many services are delivered not by one agency but by networks of agencies. For example, often federal, state, local, nonprofit, and contracted for-profit agencies all work together in a particular area like job training and placement. A future ideal system, then, would foster the exchange and integration of management data across many cooperating agencies, including nongovernmental ones.[9]

Even within a single large agency with multiple legacy systems, it is often extremely costly and time-consuming to integrate existing systems in order to produce the most useful management information. Moreover, the more ambitious the integration effort, the higher the possibilities of failure. Gartner, an independent research firm, has estimated government's failure rate at close to 60 percent for outsourced systems-integration projects (Perlman, 2002).

Managers taking their first steps toward using IT in results-based management, then, must make difficult decisions about these balances between extensive information system capabilities on one hand, and system implementation cost and risk on the other.

Balancing Information Integration and Accessibility with Privacy Risks

When all the information that applies to a single client is scattered among various unintegrated databases, management is greatly impeded but privacy is less threatened. Results-based management calls for integrating information, but gathering all the information about a client in one place, and making that information accessible to any worker that the client may contact (one-stop shopping), greatly increases the possibility of privacy infractions—because more information is available from any one leak, and because there are also more places from which it can leak (Ghere & Young, 2001). Some agencies, including defense, foreign affairs, and police, do not usually have extensive client records that raise privacy concerns. However, they need to safeguard sensitive information about national security or ongoing police investigations, and therefore they also face a tradeoff between making internal information accessible to their workers versus information security.[10]

Management information services are increasingly outsourced for efficiency reasons (Thibodeau, 2001), and this, too, may increase the risks of information leakage, because it increases the number of individuals with access to the information while decreasing the ability of government leaders to directly monitor them. In making decisions about IT and management, then, managers must first make a policy decision about the desired balance between efficiency, usually promoted by making complete information easily accessible to employees, and information security.

Balancing Political Openness and Organizational Efficiency

As noted, there are often difficult tradeoffs involved in determining employee access to some types of organizational information. More rarely, there are different, but equally difficult, tradeoffs involved when determining the extent of public access to ongoing agency management information.

In the past, citizens, reporters, and clients who wished performance data often had to wait for a printed annual report. Now many agencies provide current performance indicators on their website, often with links from the performance data to related budget information and other relevant data (Swope, 1998). Such openness happily involves no tradeoffs for the vast majority of public agencies. (In fact many are understandably disappointed about the public's unwavering lack of interest in their performance measures.)

For health, environmental, regulatory, and other agencies with politically charged missions and intense interest groups, however, such openness can result in a lessening of efficiency because interest groups are able to use this information to slow the managerial decision process and to move the ultimate decisions away from efficiency (Ghere & Young, 1998; Musso, Weare, & Hale, 2000). If these efficiency losses were exchanged for greater societal accountability, the losses would be a price well worth paying. However, often the only groups intervening are very narrow, intense interest groups such as affected industries; the agency may become more accountable to them and actually less accountable to the broader public interest.

For example, a natural resources agency that oversees a state's forests can promote internal efficiency by first setting targets for controlled burns, or for acres planted, or for board feet harvested by private companies, and then by updating progress toward those targets every week or every month. Such timely information can guide internal decisions and make the organization more focused and nimble. However, if the same information is shared with the public on a real-time basis, both environmental groups and industry groups are likely to intervene with agency leaders, legislative overseers, and their own members every time a short-term target they approve of is missed or one they disapprove of is exceeded. Managers must now spend time responding to these interventions. Openness is gained, but efficiency is lost. Managers in such controversial policy areas must decide on the appropriate balance of openness versus efficiency as they plan their use of IT in management.

Balancing Frontline Worker Empowerment Versus Organizational Uniformity

Even if frontline workers have access to agency or client information, a distinct although related question is what power they are given to act on that information. The more that all decisions are set by the top, the more the organization will treat each client uniformly, and this uniformity is often viewed as fairness. However, different clients bring subtly different problems and concerns to organizations; and if frontline workers are empowered (within some limits) to use their own discretion, the organization will be more flexible, and the morale of frontline workers will usually be enhanced as well.

Bovens and Zouridis (2002) point out that IT advances have greatly changed the roles of a certain type of "street-level bureaucrat," those frontline government workers who make decisions about whether clients are eligible for certain levels of health care benefits, public housing, food stamps, or job training.[11] In the past, such workers had to apply a great deal of individual judgment (Lipsky, 1980). Now they may be better seen as "screen-level bureaucrats" with much less discretion, because software will often suggest and sometimes even determine levels of eligibility with no human intervention.

For most large agencies, the decision about how much power to devolve to frontline workers will greatly affect the information system. Ironically, the same IT that enables frontline workers to be empowered, because it puts complete information at their fingertips, allows top management to micromanage intensely, because they can instantly call up every bit of information about what frontline workers are doing and deciding. A decision about the level of frontline empowerment that best meets society's needs, then, must precede many decisions about the information system (Ghere & Young, 1998; Bovens & Zouridis, 2002).

An Overview of the Managerial Balances: Why Management Choices Must Precede IT Choices

Many discussions of planning for IT systems focus on relatively narrow IT issues. For example, they often recommend planning for scalability, so the system can grow as the organization grows; breaking major IT projects into pieces, so they can be implemented and monitored better; and setting clear project management expectations (US GAO, 1998). These are important guidelines,[12] but they must be preceded by more fundamental decisions about the agency's direction and about what facets of management are most important in advancing that mission. Only then can meaningful decisions be made about how any new IT system can support management.

When managers are trying to determine the right organizational structure, Chandler once famously advised, they should recognize that "structure follows strategy." In other words, whether any given structure is right for an organization cannot be determined in the abstract. The organization must first choose its strategic direction, and then the right structure is the one that best fits that managerial strategy (Chandler, 1966).

This simple concept applies to information systems as well, but it is sometimes ignored by top government managers when they are making (or quite often, delegating) IT decisions. Decisions about the information systems, particularly managerial information systems, should not come before decisions about the organization's managerial direction. Managers must first decide what managerial balances—between efficiency and openness, for example—they wish to create; only then will some IT systems be correct and others ill-suited for that chosen strategic direction. We have already discussed four decisions about balances or tradeoffs that must precede many IT decisions. Beyond those four broad policy decisions, more specific managerial decisions that precede IT decisions would include:

- What are the most important decisions facing our agency, and what specific information would be most useful in helping us make those decisions?
- For each specific item of information gathered, who in the organization needs it to make better decisions, and in what form will they find it most useful?

- Who outside the organization needs to know it, and again in what form?
- What incentives do managers now have to actually use the information they are given, and how can those incentives be strengthened?

If IT experts make all the major choices about an agency's IT systems, they are in fact determining much of the agency's strategic and management direction. As Zuurmond and Snellen (1997) have said, "Managing the information architecture means managing the organization. . . . [because] these architectures control the decision premises of all organizational members." An organization's strategic decisions should not be a by-product of IT choices made by technical experts on technical grounds. Instead, they should reflect the long-range plans, management goals, and policy balances that have been thoughtfully determined by agency managers. IT choices then naturally follow.

Because it forces managers to face basic questions about the agency's policies and management, the process of designing information systems can be a powerful form of strategic analysis that can create a much more effective, results-driven agency.

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ENDNOTES

[1] Results-based management also encourages crossfunctional teams, and suggests ways of tying results to group incentives and to budgets. However, these are areas where IT has a smaller role, and so they will not be covered here.

[2] It is somewhat ironic that TQM came to the US in the 1980s through Japan, because many of its most important theories and approaches were originally developed by Americans such as Walter Shewhart, W. Edwards Deming, and Joseph Juran in the 1930s and 1940s. They never stopped proselytizing for the U.S. quality movement, but they had only spotty

success until Japanese economic gains caught the attention of corporate America in the 1980s.

[3] Reengineering included both a philosophy, which was rapidly jettisoned by most government agencies, and a series of tools, which were widely adopted and continue to be used. The philosophy held that the most effective process improvements required very radical changes that were usually conceived and implemented in a top-down manner. This philosophy proved strikingly impractical for government. The tools included approaches for decreasing cycle times and making services more seamless for customers. Among these approaches were ways of capturing information just once, parallel processing, job enlargement, and case management. These process tools and approaches proved quite useful for producing incremental government improvements. The best introduction is Linden, 1994.

[4] Of the major professional managers' societies, the American Society for Public Administration has most explicitly endorsed the approach. In 1996 it established the Center for Accountability and Performance in order, according to the ASPA website, "to address the requirement for all levels of government to move to performance-based, results driven management." The two other professional societies, ICMA and NASPAA, have also published official books and monographs on results-based government.

[5] In the public sector, increased customer satisfaction is never the only goal and often it is not the major goal. Regulatory agencies, for example—bank examiners, restaurant inspectors, highway patrol officers, etc.—will often find that doing a good job will rarely delight their most attentive customers such as bank owners, restaurant managers, and speeders. Meanwhile, their other customers (the general public) are inattentive. Other agencies—the U.S. State Department, health research agencies—will often find that most their customers do not have enough information to evaluate their performance. Therefore even though customer ratings are always useful in government, they play a less central role than they do for business, and they are accordingly only one piece of information within a range of results.

[6] Although management is traditionally the purview of middle and upper organizational levels, we will later discuss how this distinction is breaking down because both results-based management theories and IT advances have made it possible to move more "management" decisions to frontline organizational workers.

[7] The single exception is reengineering, which emphasized IT as the main reason that radical process change was both necessary and possible. See Hammer & Champy, 1993; Linden, 1994.

[8] In government, many types of Internet-based disintermediation can also produce operations-level effects, such as allowing government to buy supplies, screen bids, and sell bonds much more efficiently. Because these are not managerial-level effects, they lay outside our scope in this chapter.

[9] This would also raise questions of politics and equity because some members of the network will usually be less capable than others of incurring the costs.

[10] Some sophisticated systems do tailor the information shown by the "need to know" of each user. However, such systems are expensive and difficult to keep up-to-date as users, information and clearances change month to month.

[11] Bovens and Zouridis point out that this IT-driven loss of discretion and autonomy does not apply to all of Lipsky's street level bureaucrats. Those who deliver particularistic services to a small group of clients at a time— health care providers or teachers, for example— have not lost much discretion to IT. Parenthetically, the authors also point to a level beyond "screen level bureaucrats" where all human discretion has been removed and government decisions are made by IT systems with no face-to-face contact. They call this level "system level bureaucracies" and provide a number of European examples.

[12] As Holley, Dufner and Reed (2002) note, even these more limited planning approaches are not implemented widely.

Chapter IX

Computer Tools for Better Public Sector Management

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ABSTRACT

Almost any public sector task employing a computer can be accomplished more efficiently with a variety of tools rather than any single one. Basic tools are word processing, spreadsheet, statistics, and database management programs. Beyond these, Web authoring software, presentation graphics, optical character recognition (OCR), and project planning and management software can be helpful depending upon the job at hand.

INTRODUCTION

This chapter concerns computer applications and information technology in government. It could have been organized by public administration task such as human resource management or budgeting, but each governmental function can use several computer tools that are not unique to that function. Thus a human resource manager uses word processing software and probably a spreadsheet or a database management program. The same could be said of someone performing virtually any other administrative function. This example suggests that the topic should be organized by software type.

Topics covered in this chapter include word processing and Web publishing, spreadsheets, statistics packages, database management, presentation software, project planning and management software, decision analysis, graphics for illustrations, optical character recognition, and geographic information systems. Since most readers are likely to have substantial word processing experience, it would be unproductive to devote space to traditional word processing.

A VARIETY OF TOOLS

To make the most of their time and talents, computer users in the public sector or virtually any other setting should have access to more than one tool for nearly any task that extends much beyond typing a short memo. Access to a variety of tools is usually of greater importance than having the latest version of one.

Word Processing and Web Authoring Software

Word processing programs are designed primarily for generating print and graphic images on paper; Web authoring programs do the same thing for the World Wide Web. Web pages are generated using HyperText Markup Language (HTML) sometimes in conjunction with supplemental tools such as Java, a programming language. As an example we refer the reader to the Alabama Department of Revenue website intended to display information about taxes (http://www.ador.state.al.us/). Some of the raw HTML text for the top of the home page is as follows:

> *<meta http-equiv=”Content-Type” content=”text/html; charset=iso-8859-1"> e Franchise Tax, Alabama Taxes, Motor Fuels, Revenue Organization, Taxpayer Advocacy, Alabama Revenue Abstract, Sales & Use Tax, Severance Tax, Tobacco Tax, Revenue Procedures, Alabama Revenue, Revenue, Auto Tags, Alabama State Tax Forms, Online Filing”>*

HTML formatting instructions, called tags, are contained in the greater than/less than brackets shown above. When a browser such as Microsoft Explorer or Netscape Navigator reads a file containing HTML tags and text, it displays the file on the computer monitor according to formatting information in the tags (e.g., whether text is centered or in bold face or whether a separate file containing a graphic image is to be read and merged with the text). The

4d419794-01d0-4bee-a121-f772729ae41f

HTML syntax is large and complex. Many books numbering hundreds of pages each have been published on HTML and are available in almost any bookstore. Although HTML code may be entered using virtually any text editor, the learning curve is very steep, and there is no reason the average public servant should try to master anything but the rudiments.

Most word processing software of the last two or three generations can generate simple Web documents using HTML, but they are not the best tools for Web page creation. For most public administrators a WYSIWYG (What You See Is What You Get) HTML editor such as FrontPage is more useful.[1] An HTML editor of this sort behaves much like word processing software automatically generating HTML code for whatever formatting the user desires. In addition, an HTML editor can automatically locate links in the user's website that point to non- functioning websites (or typos on the user's part), display what might be termed an aerial view of the website allowing the designer to determine whether all of the parts fit, create forms, and much more (Kent, 2000, pp. 148-149).

The selection of a particular HTML editor will depend to some degree on the software being used by the computer on which the website is located—the Web server. In the case of most government agencies the Web server and site have already been established, and an HTML editor will be made available to the employee responsible for website creation or maintenance.

The authors' experience in using government websites suggests that they are of three basic types: marketing, informational, and interactive. Marketing sites are designed for such purposes as to attract students to universities and visitors to cities. Marketing sites usually contain photographs scanned from prints or downloaded from a digital camera together with tastefully arranged text and various decorative graphics. A certain amount of taste is required to make the marketing part of a website attractive, and the assistance of someone with a background in art might be helpful. Peter Kent (2000, p. 167) lists websites that collect badly designed websites including one called "Web Pages That Suck: Learn Good Design by Looking at Bad Design." While the bad website collections dramatize how Web designs can go horribly wrong, fledgling designers will also want to visit sites of organizations similar to theirs to see what works.

Most Web pages presented by government agencies are meant to be entirely informational. Beyond basic neatness, the only design consideration that is important is clarity and consistency. The State of Alabama Department of Revenue site identified above is intended solely to convey information about Alabama taxes to individual and business taxpayers and other interested parties. This site's home page directs the user to different taxes as well as summaries of the tax system as a whole. The home page is a model of clarity, but the rest of the site suffers from two problems. First, the pages for each major type of tax (e.g., sales, property, income) were apparently designed by individual divisions responsible for the administration of those taxes. These pages vary widely in style (e.g., fonts, formatting, and whether buttons are used instead of simple lists) and types of information provided. To a substantial degree, the variation in information is due to the differing nature of the taxes being described, but the assortment of layout styles conveys an unprofessional image. The second problem is that some information is stored in scanned (PDF) format for no apparent reason except perhaps that it was convenient for the website creator. Scanned images of text are the equivalent of photographs of original printed pages. Some academic journals are available on the Web in this format because the publishers want page citations from the Web to be identical to those in the original printed version. Presenting text in editable text mode (such as ordinary e-mail) means that page numbers may vary substantially from the original printed format. Also, if graphics such as diagrams or pie charts are included it is necessary to use a scanned image or HTML. The major drawback of scanned images is that they require far longer to download than editable text, especially if a telephone modem is being used.

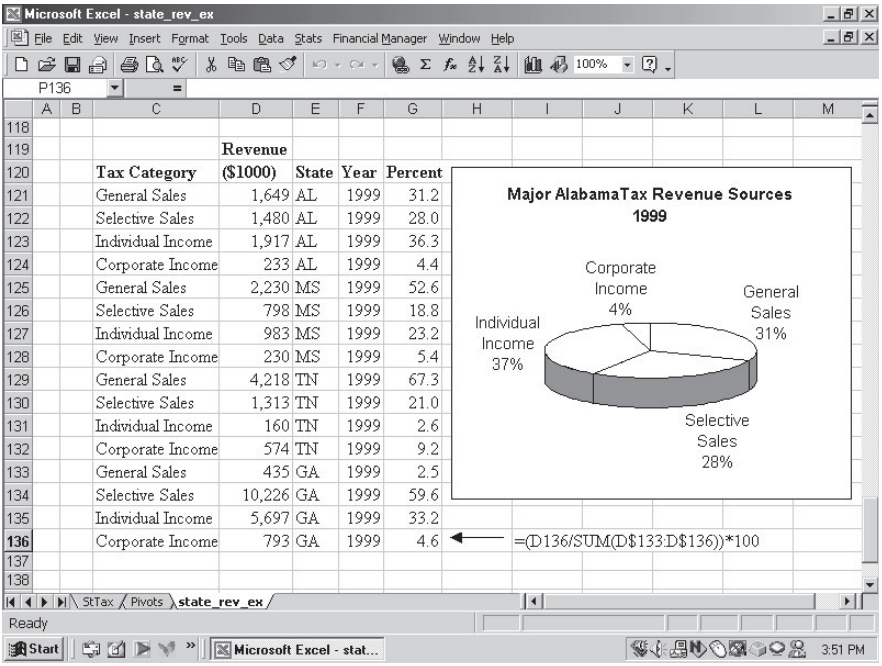
Interactive websites are the most difficult to build (Kent, 2000, pp. 195-271). Interactive sites gather information from users. They may take orders for goods or services, maintain an inventory of goods and services available, and accept credit card information, among other tasks. An example is an online university class registration system. Interactive sites require specialized programming skills beyond the reach of most public administrators. Marketing and informational websites merely display information, and programming skills are not needed to develop them.

THE SPREADSHEET, STATISTICS, AND FORECASTING

No microcomputer tool is more widely used for numerical data storage and analysis than the spreadsheet. For example, among state governors' budget offices the microcomputer spreadsheet is the first choice for data storage, analysis, and graphics (Grafton & Permaloff, 1996). Four years ago we wrote that despite its suitability to a variety of tasks, many public administration practitioners and students know little about spreadsheet operations beyond basic budgeting, even when a spreadsheet such as Excel resides on their hard disks as part of a suite of programs. We see no reason to amend these words. The widespread unfamiliarity with this powerful tool's many uses spans local, state, and federal governments and functional areas such as public health, justice and public safety, and the military.

A spreadsheet is a grid of columns labeled alphabetically and rows labeled numerically. The rectangular intersection of a column and row is a cell, and a cell's location is specified by its column letter and row number such as cell A1—the cell in the upper left corner. Three major kinds of information may be entered into a cell: text, numbers, and formulas that perform calculations on the numbers or on other formulas. Older spreadsheets also permitted macros (or parts of macros) to be stored in a cell. Macros may be a series of stored key strokes that relieve the tedium of repetitive work or full programs with all the characteristics of any computer program, including decision-making capability. Excel, now the dominant spreadsheet, stores macros and Visual Basic programs (often constructed partly from macros) outside the spreadsheet grid (Albright, 2001; Cummings, 2001). In addition to performing calculations based on user-inputted formulas, a spreadsheet can produce graphs such as pie and bar charts based on selected data, and it can be used to query a database stored in the spreadsheet. Spreadsheets can also perform statistical analysis with built-in tools and add-ins (defined next).

Figure 1. Typical Spreadsheet



Microsoft Excel - state_rev_ex
File Edit View Insert Format Tools Data Stats Financial Manager Window Help
100%
P136
=
Major AlabamaTax Revenue Sources
1999
Corporate Income 4%
General Sales 31%
Individual Income 37%
Selective Sales 28%
StTax
Pivots
state_rev_ex
Ready
Start
Microsoft Excel - stat...
3:51 PM

Tax Category	Revenue ($1000)	State	Year	Percent
General Sales	1,649	AL	1999	31.2
Selective Sales	1,480	AL	1999	28.0
Individual Income	1,917	AL	1999	36.3
Corporate Income	233	AL	1999	4.4
General Sales	2,230	MS	1999	52.6
Selective Sales	798	MS	1999	18.8
Individual Income	983	MS	1999	23.2
Corporate Income	230	MS	1999	5.4
General Sales	4,218	TN	1999	67.3
Selective Sales	1,313	TN	1999	21.0
Individual Income	160	TN	1999	2.6
Corporate Income	574	TN	1999	9.2
General Sales	435	GA	1999	2.5
Selective Sales	10,226	GA	1999	59.6
Individual Income	5,697	GA	1999	33.2
Corporate Income	793	GA	1999	4.6

← =(D136/SUM(D$133:D$136))*100

As we suggested above, perhaps the spreadsheet's most common application is government revenue presentation and forecasting and budget formulation and presentation. Figure 1 displays major state and local tax revenue sources for four states for 1999. The entire data set extends from 1992-1999. It also shows spreadsheet column and row identifiers. The inclusion of column and row designations and/or the columns and rows themselves in the printout is optional and ordinarily would not be done in presentation materials distributed in printed form, projected on a screen, or displayed in a website. They were included here to facilitate the discussion below. Once data and associated labels and formulas are keyed into a spreadsheet, such as the one shown in Figure 1, it is called a worksheet.

Several features of this worksheet are worth noting:

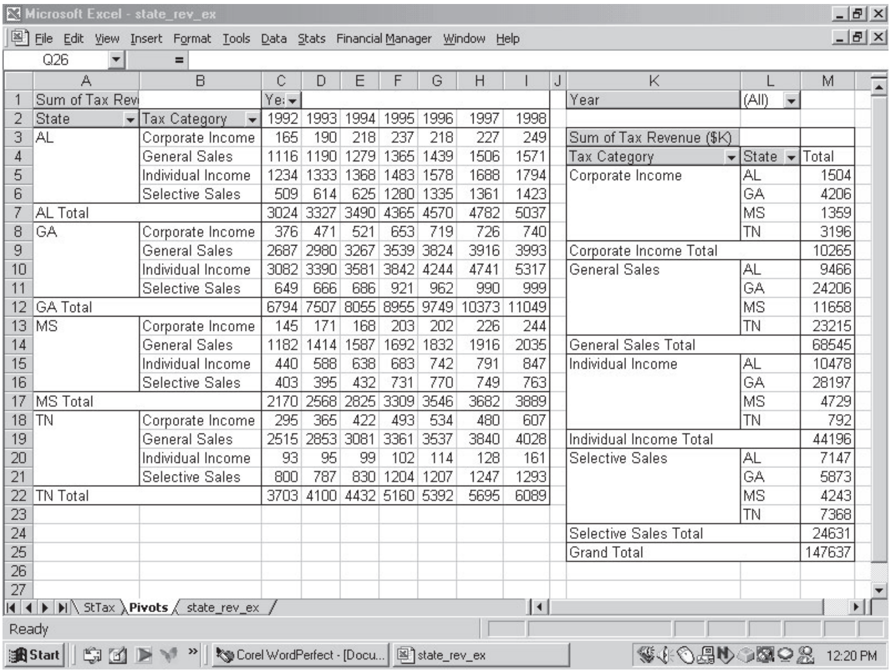
- The tax categories such as "General Sales," the state initials, and the years were keyed in only once and then copied.
- Column G shows the percentage of the total revenues for these sources for each state and each year. The formula in cell G136 is typical of the others in column G. The formula takes the number to the left in column D and divides it by the sum of revenues for Georgia in 1999 (in this case) and multiplies by 100. There are several ways this result could have been obtained.
- The pie chart is one of several pie chart formats that could have been selected. Here it is shown along with the data, but it could also have been printed alone on an entire page.

The Figure 1 worksheet was set up for data input convenience—one state and one year at a time. It happens that this arrangement of data is convenient for generating the pie chart, but if a time series plot of general sales tax revenues for one state from 1992-1999 is desired, the data are inconveniently scattered over more than 100 rows. There are several ways of collecting the data in eight successive rows. One approach is to invoke the Excel data filter choice. This is done in Excel by clicking in succession Data, Filter, and Autofilter. This choice automatically generates menus at the top of the worksheet—one menu for each column. The menu in column C contains all of the tax categories in the column. In this case we would select General Sales. The menu in column E contains the state designations. By selecting one of these (together with the previous choice of General Sales) the screen would display only General Sales Tax revenues for a single state from 1992-1999. A time series plot may now be generated. Data Filter makes it appear that the original database has been erased except for the requested information, but in fact the original data can be recalled with two mouse clicks.

Data Filter is sometimes called a data query system. It can be used to pose complex questions regarding the content of a database. Considering that government databases may contain thousands of rows and many dozens of columns, the convenience of Data Filter is evident (Berk & Carey, 1998, pp. 42-47).

The database in Figure 1 contains five dimensions—Tax Category (e.g., sales, income), Tax Revenue (dollar amount), State, Year, and Percent (percentage of a state's tax revenue contributed by each tax). We could have added a sixth dimension such as per capita tax revenue. If we had included all of the states, we could have added region as a seventh dimension. There is no way to display all of these data on a single worksheet in a manner that allows the reader to see all of the dimensions clearly. For example, simple as our worksheet is, it is difficult to see the time series data described immediately above. We have just seen that by using Data Filter we can essentially suppress all data except that in which we are interested. Another somewhat less elegant but still effective approach is to sort data in alphabetical order (the Excel menu choices are Data, Sort) by State and Tax Category so that, for example, Alabama and General Sales are grouped together in order of year.

Figure 2. Two Pivot Tables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	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Sum of Tax Rev		Ye:								Year	(All)	
2	State	Tax Category	1992	1993	1994	1995	1996	1997	1998				
3	AL	Corporate Income	165	190	218	237	218	227	249		Sum of Tax Revenue ($K)		
4		General Sales	1116	1190	1279	1365	1439	1506	1571		Tax Category	State	Total
5		Individual Income	1234	1333	1368	1483	1578	1688	1794		Corporate Income	AL	1504
6		Selective Sales	509	614	625	1280	1335	1361	1423			GA	4206
7	AL Total		3024	3327	3490	4365	4570	4782	5037			MS	1359
8	GA	Corporate Income	376	471	521	653	719	726	740			TN	3196
9		General Sales	2687	2980	3267	3539	3824	3916	3993		Corporate Income Total		10265
10		Individual Income	3082	3390	3581	3842	4244	4741	5317		General Sales	AL	9466
11		Selective Sales	649	666	686	921	962	990	999			GA	24206
12	GA Total		6794	7507	8055	8955	9749	10373	11049			MS	11658
13	MS	Corporate Income	145	171	168	203	202	226	244			TN	23215
14		General Sales	1182	1414	1587	1692	1832	1916	2035		General Sales Total		68545
15		Individual Income	440	588	638	683	742	791	847		Individual Income	AL	10478
16		Selective Sales	403	395	432	731	770	749	763			GA	28197
17	MS Total		2170	2568	2825	3309	3546	3682	3889			MS	4729
18	TN	Corporate Income	295	365	422	493	534	480	607			TN	792
19		General Sales	2515	2853	3081	3361	3537	3840	4028		Individual Income Total		44196
20		Individual Income	93	95	99	102	114	128	161		Selective Sales	AL	7147
21		Selective Sales	800	787	830	1204	1207	1247	1293			GA	5873
22	TN Total		3703	4100	4432	5160	5392	5695	6089			MS	4243
23												TN	7368
24											Selective Sales Total		24631
25											Grand Total		147637
26													
27													

Still another approach to the problem of displaying data of more than two dimensions is the pivot table (Excel menu choices Data, Pivot Table). We lack the space to explain the steps required to build a pivot table, but many reference works and Excel help screens explain it clearly (Berk & Carey, 1998, pp. 205-216). Figure 2 shows our data organized in two ways using the pivot table feature. It took little more time to create these two tables than it did to print them. Since time is often presented in tabular and graphical form on the horizontal axis, we placed the years along the top row. However, the placement of State and Tax Category depend on how one wishes to look at the data. The first pivot table groups the tax categories by state permitting comparisons of tax revenues within each state. The second pivot table groups the data by Tax Category first and then State. This allows us to compare revenues of a given tax among the states. This is not a very meaningful comparison because the states are of different size, but we want to keep the example simple. If our database had included all of the dimensions listed above, we could have included them in our pivot table; but, it would have become too complex to read with any clarity. For this reason, the pivot table procedure allows us to include and exclude whatever data we want.

Benefit-Cost Analysis

Benefit-cost analysis compares the benefits and costs of various choices and selects the choice that yields the highest net benefit (Stokey & Zeckhauser, 1978, pp. 134-176; Boardman, Greenberg, Vining, & Weimer, 2001; Ammons, 2002, pp. 107-166). In practice, most benefit-cost problems involve capital expenditures where benefits and costs are received and spent over a period of years. With data of this sort it is necessary to reduce the benefit and cost data to their present-day equivalents or present value.

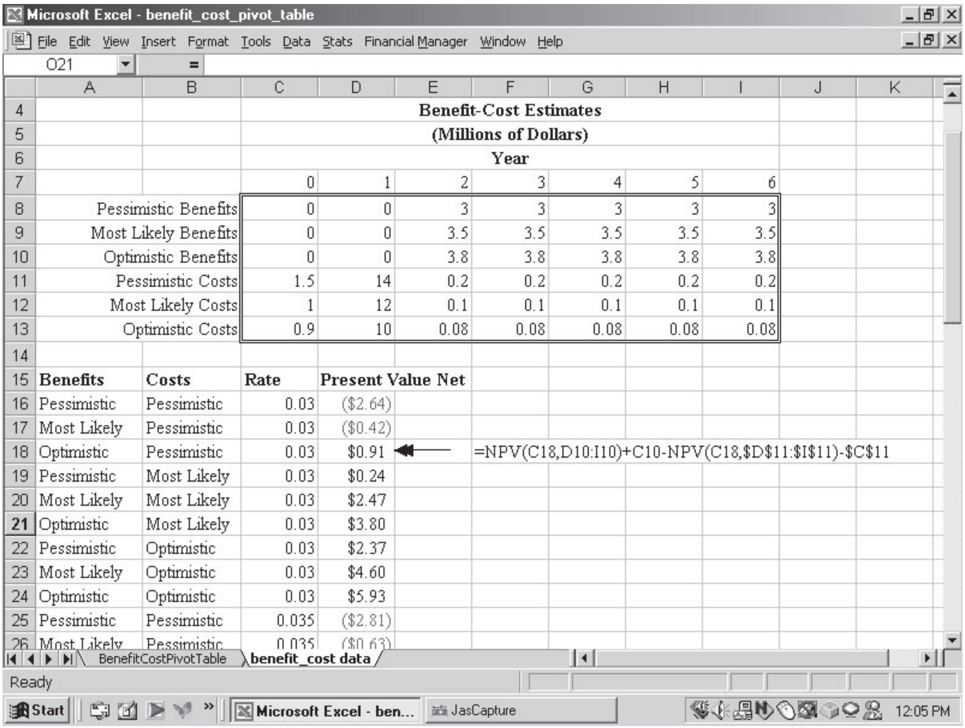
The formula for calculating present value for any benefit or cost stream is:

$$PV = S_0/(1+r)^0 + S_1/(1+r)^1 + S_2/(1+r)^2 + \ldots + S_n/(1+r)^n$$

S_n represents any sum of money (benefit or cost) in year *n* and *r* is the discount rate. The value of *n* may be the physical life of a project or its technologically useful life.

Performed on a hand calculator, the benefit-cost analysis of one or two streams of figures using the above formula is of no difficulty, but an actual benefit-cost analysis performed to aid decision making (as opposed to providing decorative support for decisions already made) typically involves sensitivity or "what if" analysis applied to combinations of benefits, costs, and discount

Figure 3. Benefit/Cost Analysis on a Spreadsheet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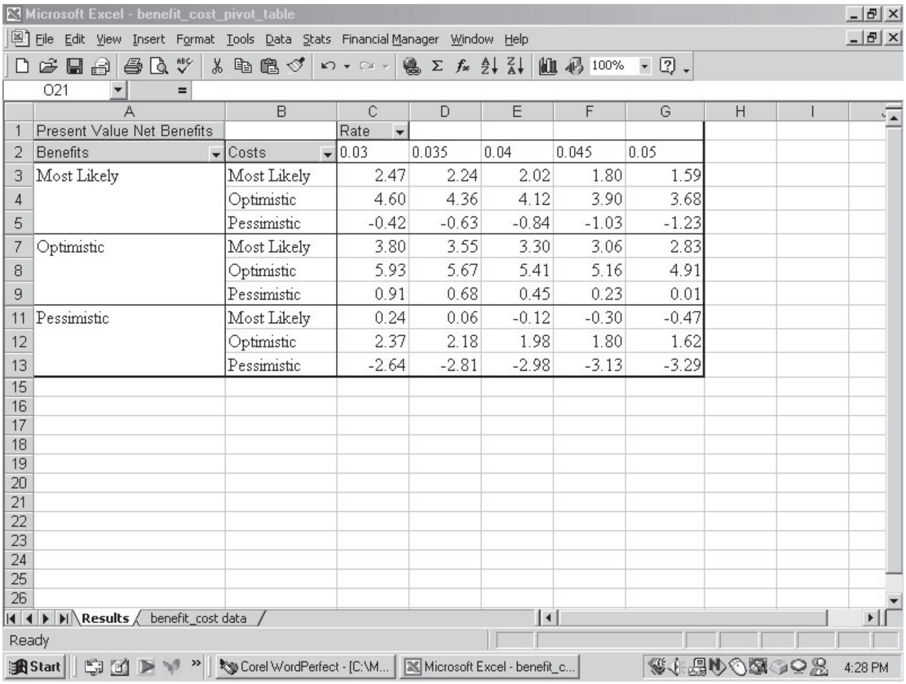
	A	B	C	D	E	F	G	H	I	J	K
4			Benefit-Cost Estimates								
5			(Millions of Dollars)								
6			Year								
7			0	1	2	3	4	5	6		
8	Pessimistic Benefits		0	0	3	3	3	3	3		
9	Most Likely Benefits		0	0	3.5	3.5	3.5	3.5	3.5		
10	Optimistic Benefits		0	0	3.8	3.8	3.8	3.8	3.8		
11	Pessimistic Costs		1.5	14	0.2	0.2	0.2	0.2	0.2		
12	Most Likely Costs		1	12	0.1	0.1	0.1	0.1	0.1		
13	Optimistic Costs		0.9	10	0.08	0.08	0.08	0.08	0.08		
14											
15	**Benefits**	**Costs**	**Rate**	**Present Value Net**							
16	Pessimistic	Pessimistic	0.03	($2.64)							
17	Most Likely	Pessimistic	0.03	($0.42)							
18	Optimistic	Pessimistic	0.03	$0.91	← =NPV(C18,D10:I10)+C10-NPV(C18,$D$11:$I$11)-$C$11						
19	Pessimistic	Most Likely	0.03	$0.24							
20	Most Likely	Most Likely	0.03	$2.47							
21	Optimistic	Most Likely	0.03	$3.80							
22	Pessimistic	Optimistic	0.03	$2.37							
23	Most Likely	Optimistic	0.03	$4.60							
24	Optimistic	Optimistic	0.03	$5.93							
25	Pessimistic	Pessimistic	0.035	($2.81)							
26	Most Likely	Pessimistic	0.035	($0.63)							

rates. The basic question being posed by any kind of sensitivity analysis is how will the result be affected by change in inputs—in this case benefits, costs, and the discount rate. If the estimates for each of these are all performed using a hand calculator, one is facing a considerable amount of work. With a spreadsheet such a prospect represents no problem.

Figure 3 shows a typical benefit-cost situation. In the first two years benefits are zero because the project in question (e.g., a building) is under design and construction. The design and construction costs are relatively high compared to annual benefits. Because high design and construction costs are incurred in the first few years, they are discounted relatively little by the present value formula. The smaller benefit figures are more and more heavily discounted as they extend further into the future. Thus the higher the discount rate, which governs the severity of the discounting, the worse the project will look as calculated either by net benefits (benefit minus cost) or the benefit-cost ratio (benefit divided by cost). Obviously, results also depend on cost and benefit estimates.

Figure 4. Pivot Table Summarizing Benefit/Cost Results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	A	B	C	D	E	F	G
1	Present Value Net Benefits		Rate				
2	Benefits	Costs	0.03	0.035	0.04	0.045	0.05
3	Most Likely	Most Likely	2.47	2.24	2.02	1.80	1.59
4		Optimistic	4.60	4.36	4.12	3.90	3.68
5		Pessimistic	-0.42	-0.63	-0.84	-1.03	-1.23
7	Optimistic	Most Likely	3.80	3.55	3.30	3.06	2.83
8		Optimistic	5.93	5.67	5.41	5.16	4.91
9		Pessimistic	0.91	0.68	0.45	0.23	0.01
11	Pessimistic	Most Likely	0.24	0.06	-0.12	-0.30	-0.47
12		Optimistic	2.37	2.18	1.98	1.80	1.62
13		Pessimistic	-2.64	-2.81	-2.98	-3.13	-3.29

The table at the top of Figure 3 contains six sets of pessimistic, most likely, and optimistic benefits and costs. We are assuming a range of discount rates from three to five percent increasing in one-half of one percent increments. The data below the top table (only part of which in visible in Figure 3) consists of all possible combinations of benefits, costs, and discount rates; it is used to build a pivot table to display the results in a readable fashion. The formulas in the present value column all resemble the one that refers to cell D17. Each formula begins with the NPV function.

The syntax of the Present Value (NPV) function is =NPV (rate, range), where *rate* is the discount rate and *range* is a range of cells. C18 contains the discount rate. As the Excel's help utility notes, the NPV function begins discounting with the first cell in the range specified in the formula. Thus if the block D10:I10 was replaced with C10:I10, the discounting would begin one year too early. The cell address of the benefit or the cost for year 0 is added or subtracted separately.

The pivot table in Figure 4 summarizes all the combinations of benefits, costs, and discount rates within the specified ranges. Note that along each row the present value figures decline with increasing discount rates as it must. This distinctive pattern does not guarantee that the functions in Figure 4 were entered correctly, but it suggests that they were. This table would give decision makers a sense that optimistic or most likely assumptions would produce positive results, even at the highest calculated discount rate, but that some inclusion of pessimistic benefit or cost assumptions can generate negative results.

Spreadsheets and Statistics

Spreadsheets possess statistical computing capabilities adequate for many public administration tasks. Excel can perform basic descriptive statistics, curve smoothing, analysis of variance, multiple regression, random number generation, sampling, *t*-test, and others. These capabilities are part of the Analysis ToolPak, an add-in that comes with all versions of Excel that are likely still to be in use. An add-in is a computer program that when installed merges with a base program (Excel in this case), making the add-in an integral part of the base program. Excel's Analysis ToolPak can be supplemented by another add-in called StatPlus available with Data Analysis with Microsoft Excel (Berk & Carey, 1998, and other years). Various editions of this reasonably priced text contain versions of StatPlus designed to work with specific versions of Excel and Windows. This book is perhaps the most clearly written and informative introduction to spreadsheet usage and introduction to statistics on the market. Relatively advanced statistical analysis or the analysis of databases exceeding roughly 5,000 observations and 100 variables (with computers of ordinary memory capacity) cannot be done readily or at all with Excel, but for many administrative jobs that involve smaller databases it may be adequate. Advanced work with large databases is more conveniently performed using statistics packages to be discussed later.

Spreadsheets are better tools than statistics packages for data entry, data editing, data storage, and printing. A statistics package is a computer program optimized for statistical analysis. Generally speaking, the best statistics packages (e.g., SYSTAT, SPSS, and NCSS) are more suitable for statistical analysis than are spreadsheets, but spreadsheets are superior for printing raw data as well as performing a wide variety of nonstatistical quantitative chores. If spreadsheet data entry follows simple rules specified by all leading statistics package manufacturers, the data may be exported to the statistics package; leading statistics packages can read spreadsheet files almost as easily as they can their native format.

Data to be read by a statistics package should be arranged so that the top row is devoted to variable names and each subsequent row is an observation. For example, if the analyst is trying to understand the relationship between university funding and state economic performance, data would be arranged as follows:

	A	B	C
1	STATE	IN9894	ECAP9692
2	MAINE	492.85	.00742
3	NEWHAMP	-623.21	.00731
4	.	.	.
5	.	.	.

where STATE is a text variable, IN9894 is the change in per capita income in the years 1994-98, and ECAP9692 is the difference in university enrollment in the years 1992-96 as a fraction of a state's population. In this example there would be 51 rows of data for the 50 states and the District of Columbia. Elsewhere on the worksheet the definitions of the variables can be entered along with data sources and other information. Some statistics packages allow such notes to be added to a data set, but many do not.

If it is determined that a variable (column) is no longer needed, it can be easily eliminated in a spreadsheet. If a transposition of variables (columns) can aid readability, this is much more easily accomplished with a spreadsheet than statistics package. In the above example, we might have data for two decades (enrollment, population, and income data for each year), and we may want to locate all per student expenditure variables in adjoining columns. Such a rearrangement of data is a trivial matter with a spreadsheet but awkward at best with a statistics package.

Data sets can easily number 50, 100, or more variables. To avoid mistakes it is important that a key variable, such as STATE in this example, remain in view. With many statistics package data entry screens, when more than approximately five variables have been added, the first column (variable) scrolls to the left out of sight. The invisibility of the STATE variable could easily result in the user entering data for Maryland when it should be in the Massachusetts row. With a spreadsheet the STATE column may be frozen so that it is always in view. Similarly, with some statistics packages, once data have been entered for roughly the first half of the states, variable names scroll away upward. In a spreadsheet variable names can also be frozen in place. One can also view two entirely different parts of the worksheet with a split window—a feature we have not seen in any statistics package data input screen.

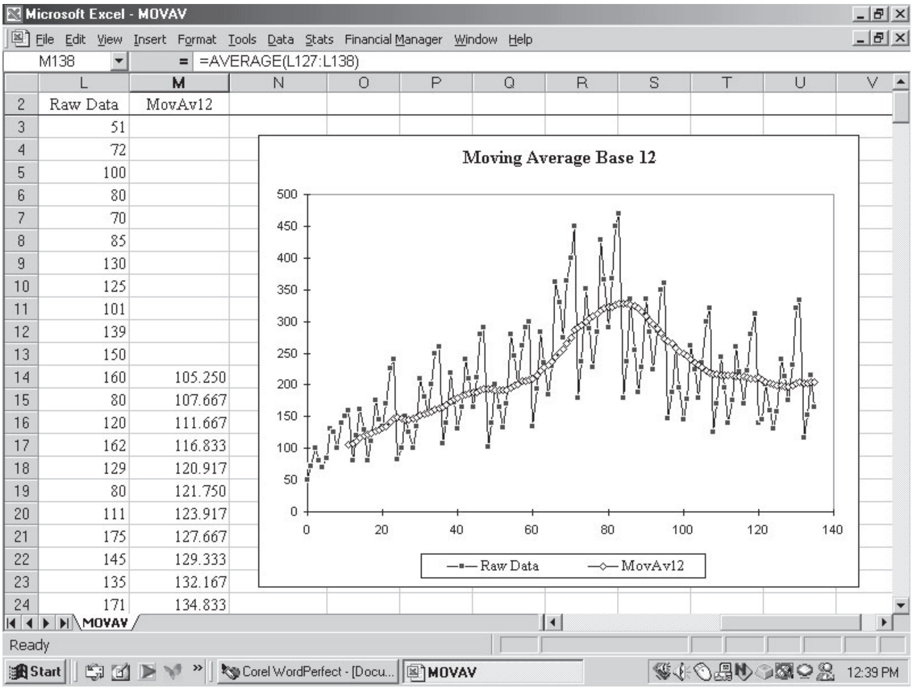
Most statistics packages lack even elementary print formatting capabilities, producing crude-looking or confusing raw data printouts. The statistics package output may be saved in a format readable by a word processing program (or a spreadsheet) where the cleanup of layout and fonts may be accomplished. A spreadsheet allows complete control over what appears on which printout page. It is far superior to a statistics package in terms of the appearance of the printout.

Curve Smoothing and Forecasting

A time series data set is "a sequence of observations taken at evenly spaced time intervals" (Berk & Carey, 1998, p. 342). Although it is characterized by serious theoretical weaknesses, the single moving average is one of the most common tools of applied time series analysis, especially among financial securities analysts. The single moving average is easily calculated and plotted using a spreadsheet.

The time series data in Figure 5 might represent government tax revenues over a period of weeks. The data are relatively noisy. To highlight trends obscured by day-to-day fluctuations and to perform rudimentary forecasting, it can be smoothed by calculating the mean of data over a number of time periods—in this case 12 weeks (Berk & Carey, 1998, p. 356). The first moving average data point is the mean of the first 12 weeks of raw data, the

Figure 5. Moving Average Data and Plot for Forecasting



M138 =AVERAGE(L127:L138)

	L	M
2	Raw Data	MovAv12
3	51	
4	72	
5	100	
6	80	
7	70	
8	85	
9	130	
10	125	
11	101	
12	139	
13	150	
14	160	105.250
15	80	107.667
16	120	111.667
17	162	116.833
18	129	120.917
19	80	121.750
20	111	123.917
21	175	127.667
22	145	129.333
23	135	132.167
24	171	134.833

second moving average data point omits the first week of raw data and includes the thirteenth, and so forth.

The distance between the moving average curve and the raw data curve is sensitive to changes in trend. Because each point on the moving average curve represents the past, each point on the moving average will be below raw data when the trend is up. However, when the rate of increase begins to diminish, the distance is reduced, and this change is regarded as significant by many financial analysts. Similarly, the moving average remains above raw data when the trend in the raw data is downward. A lessening in the rate of decrease of the raw data will also produce a reduction in the distance between the moving average and raw data. The moving average can easily be calculated by entering the formula or by using the Excel trend line dialog box.

In financial forecasting, moving averages of 30, 60, or even 90 days are common. In such calculations each day is treated as being equally important, i.e., data from a day 30, 60, or 90 days ago is accorded as much weight as yesterday's data. It seems likely that yesterday's data is somewhat more important than data from a day before that, which in turn is more important than data from three days ago, and so forth. A family of curve- smoothing techniques known as exponential smoothing takes this likely truth into account by systematically weighting more recent time periods more heavily than earlier ones (Fosback, 1987, chap. 41). Excel also contains a number of exponential smoothing techniques (see Berk & Carey, 1999, pp. 358-373).

Many time series data sets contain several components. As we have already seen, one such component may be trend, a relatively long-term tendency to move upward or downward. Another time series component may be seasonality: in a given month or quarter the data may generally be average, below average, or above average for the year. City sales tax revenues are often seasonal with, for example, revenues for November and December being above average because of holiday business. Within a quarter or month there may also be weekly patterns or other cycles. Finally, time series data also contains random variation. A family of techniques called complex time series analysis breaks data of this sort into its component parts (trend, seasons, and cycles) and reassembles those parts into the future generating a forecast. Such forecasts reproduce the long-term trend of the data set and the ups and downs of seasons and cycles to produce impressive looking graphs. Of course, the accuracy of such forecasts depends on whether past trends, seasonal patterns, and cycles are maintained. Excel and StatPlus can almost automatically perform complex time series analysis using trend and season but not cycle. The statistics package NCSS contains one of the most sophisticated time series analysis modules that we have seen among general purpose statistics packages (see below).

Sampling

Spreadsheets contain functions that can be used to generate random numbers convenient for sampling. In Excel the function RAND() generates a random number greater than or equal to 0 and less than 1. For example, entering =RAND() into three cells yielded .917547614, 364495084, and .209362913. The numbers are evenly distributed. In other words, there is an equal likelihood that any digit will appear in any of the decimal places.

The Excel help utility advises: “To generate a random real number between a and b, use: RAND()*(b-a)+a”. Generation of integers (whole numbers) instead of decimals can be accomplished by combining the above technique with the INT function which rounds down to the nearest integer. For example, random numbers between 1 and 500 are generated by the formula INT(RAND()*500)+1.

Worksheets can be designed to generate simple random samples and systematic samples with or without stratification. With the spreadsheet rows representing cases or subjects, each row may be numbered quickly and those numbers used with a formula to generate a simple random sample. The stratified systematic sample is first developed by sorting the data on one or more variables (for example, sex). Using a formula to generate a skip interval (population size divided by sample size), it is easy to generate another formula for sampling the list once a random start number is generated by simple random sampling within the first interval. If the data were sorted by sex, the resulting sample will have numbers of males and females proportionate to their numbers on the list.

Spreadsheets contain a calendar with dates represented by integers that can be used to generate random dates between desired limits. The number 1 represents January 1, 1900, something that the reader can confirm by keying 1 into any cell and formatting it as a date (Format, Cell, Number, Date). The generation of random dates is accomplished by determining what integers represent the desired dates and setting up the correct INT(RAND()) formula.

Linear Programming

Linear programming is a technique for minimizing or maximizing a variable in the face of constraints. We might, for example, be attempting to minimize cost in a government cartography shop by making the most efficient use of equipment and personnel or to maximize the use of city garbage trucks by minimizing travel time between where they start in the morning, pickup locations, and dump locations (both examples are actual applications). Spreadsheets can perform such calculations. Explaining how data for a particular situation are arranged for linear programming solution in a spreadsheet requires far more space than is available, but many texts on advanced spreadsheet usage provide guidance (Gips, 1997, Chap. 8; Albright, Winston, & Zappe, 1999, Chaps. 14-15; Weida, Richardson, & Vazsonyi, 2001, Chap. 14).

Database Applications

Everything regarding spreadsheet usage up to this point has concerned databases, but there are specific data storage and manipulation operations known collectively as database management. The traditional database structure is identical to the column (variable) and row (observation) arrangement discussed above except that in database management, columns are known as fields and rows as records. Inventories, mailing lists, and room assignments in buildings are examples of the kind of information stored and processed as part of database management operations.

Spreadsheets can be used for this purpose if the number of records does not exceed the maximum number of rows in the spreadsheet. This amount varies depending on spreadsheet manufacturer and version, and it also may be limited by the amount of memory (RAM) in the computer. The practical maximum number of records is also governed by how the user plans to manipulate data; many operations can take additional space. Very roughly speaking, a database larger than 5,000 records (in many applications the maximum could be smaller) should be processed using a database management program such as Access or the easy-to-use, powerful, and reasonably priced Alpha-Five. Such programs have much larger data handling capacities and other capabilities to be discussed below that often make them better database management tools than a spreadsheet. Statistics packages also have data handling capacities that are much larger than spreadsheets, but statistics packages lack a full range of database manipulation capabilities, as well as convenient data entry features discussed above.

We have already described the data filter function which is a basic database management operation. Sorting is another. Much can be learned from a data set by sorting. Assuming one's computer has sufficient memory capacity, a database management program or spreadsheet is an effective sorting tool. Data may be sorted in ascending or descending order, alphabetically or numerically.

STATISTICS PACKAGES

As noted above, spreadsheets can perform statistical calculations, but, if those operations are many in number, involve relatively sophisticated techniques, and/or involve large data sets, statistics packages such as SYSTAT, SPSS, or NCSS are far superior to spreadsheets (Grafton & Permaloff, 1998). For some calculations statistics packages are the only tool that can be used by the nonprogrammer.

In public administration applications a statistics package might be used for operations as elementary as producing descriptive statistics (even for this purpose a statistics package is more convenient than a spreadsheet if work is to be done on more than a few dozen variables) or as advanced as leading-edge statistical analysis.

Regression Analysis

Regression analysis can be employed to explain the relationships between and among variables, and it can be used alone or in concert with other techniques for forecasting. Regression analysis is one of the most commonly described techniques in the statistics literature, and there is no point in our duplicating the many fine treatments of this subject (See Schroeder, Sjoquist, & Stephan, 1986; Wilkinson, Blank, & Gruber, 1996; Berk, 1998, Chaps. 9-10; Chaps. 4-7; Garson, 2002). An example of one application of regression analysis concerns the relationship between the change in per capita income and the change in university enrollment for the states. This example is part of an actual test of a university lobbyist's claim that a state's economic well being was directly proportional to the number of people enrolled in universities. Using the language of statistics, a state's economic health was the dependent variable being acted on by the independent variable, higher education enrollment. Regression analysis allows the user to determine how much, if any, variation in a state's economic health is explained by variation in higher education enrollment.

Regression analysis is used in the fields of human resource administration and justice and public safety to analyze whether discrimination based on race, sex, or other illegal factors is statistically likely. In this instance, regression analysis with several independent variables (multiple regression) is often the tool of choice (Berk & Carey, 1998, pp. 268-297). Regression also can be used for forecasting time series data, making time the independent variable (horizontal axis). The resulting regression line or the regression equation can be used to forecast the dependent variable, which can be anything from tax revenues to jail inmate populations.

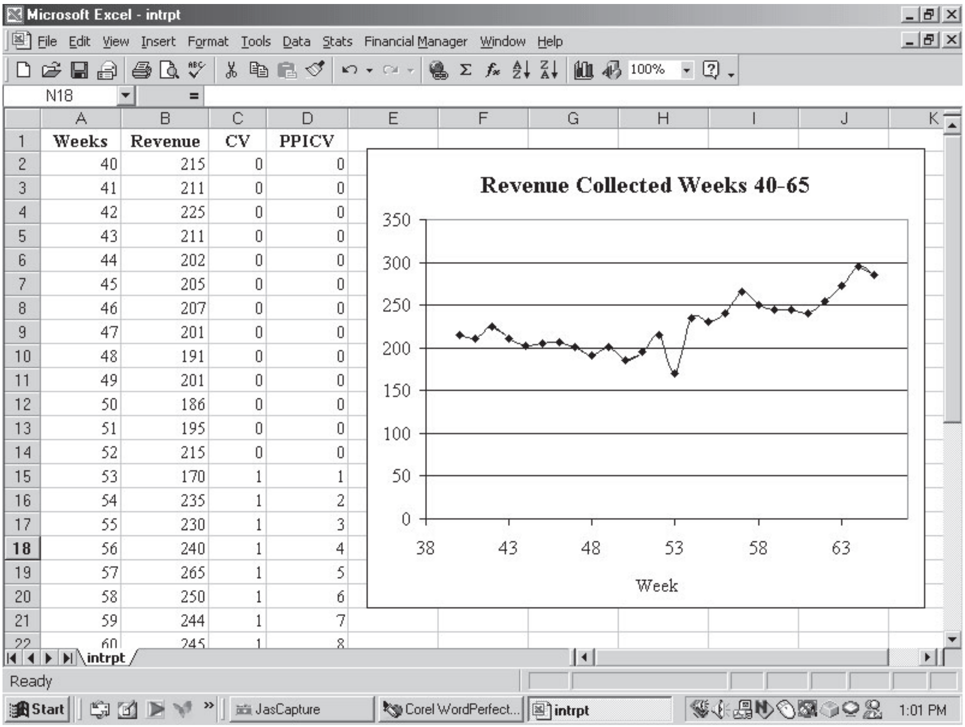
Interrupted Time Series Analysis

Interrupted time series analysis, an application of regression analysis, is an especially helpful analytical tool for policy analysis (Welch & Comer, 1988, pp. 289-295). The authors used it to test the claim that George Wallace's first term as governor had a positive effect on education spending in Alabama (Permaloff & Grafton, 1995, pp. 319-325).

With interrupted time series analysis data are available for a number of time periods before and after an event, such as the election of a new governor or a change in tax laws. This extremely useful technique measures whether the event has made a statistically significant difference and the nature of that difference. There are two basic kinds of statistically significant differences that an event can produce: an abrupt increase or reduction and a long-term increase or reduction. In addition, an event may produce no abrupt change and/or no long term change. These alternative yield nine possible combinations: no immediate change but a long term increase; no immediate change but a long term reduction; and so forth.

As an example we can apply this technique to the raw data in Figure 5. If we assume that change in a tax law occurred in week 77, we would have no

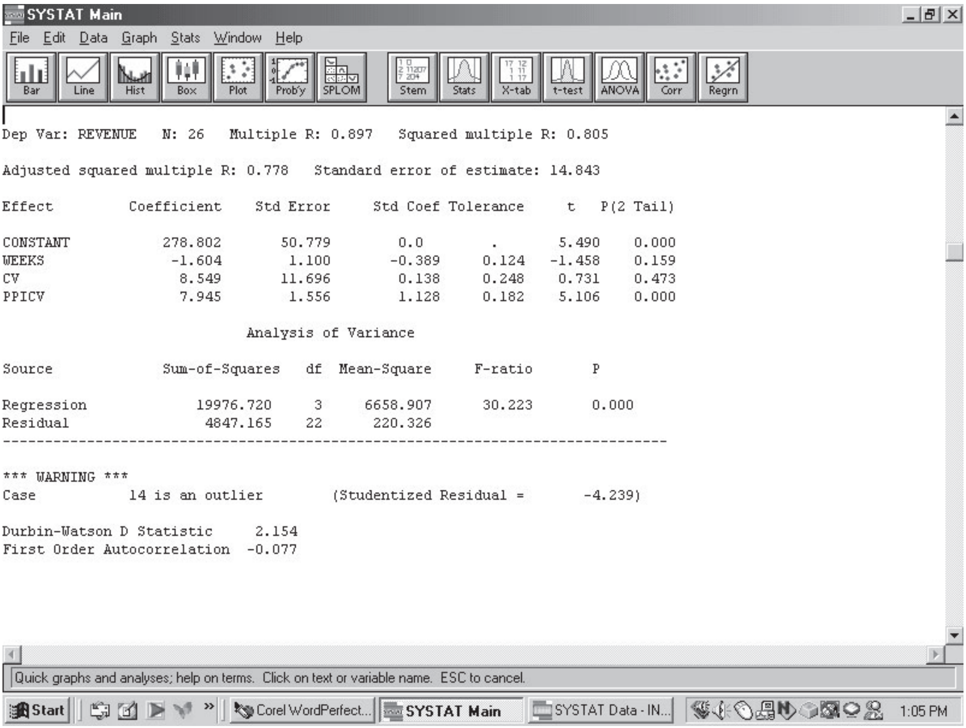
Figure 6. Interrupted Time Series



	A	B	C	D
1	Weeks	Revenue	CV	PPICV
2	40	215	0	0
3	41	211	0	0
4	42	225	0	0
5	43	211	0	0
6	44	202	0	0
7	45	205	0	0
8	46	207	0	0
9	47	201	0	0
10	48	191	0	0
11	49	201	0	0
12	50	186	0	0
13	51	195	0	0
14	52	215	0	0
15	53	170	1	1
16	54	235	1	2
17	55	230	1	3
18	56	240	1	4
19	57	265	1	5
20	58	250	1	6
21	59	244	1	7
22	60	245	1	8

difficulty concluding by inspection that the change had a statistically significant long-term impact on revenues. We focus on another part of the data set characterized by somewhat less abrupt change. Let us examine the data from week 40 to week 65. Assume that an event (e.g., a tax law change) occurred in week 53 corresponding to the sharp drop from 215 to 170. After that the trend was upward. Figure 6 shows this part of the data set with two additional variables CV and PPICV. CV is a dummy variable. This means that numbers indicate the presence or absence of something (normally with zeros representing absence and ones representing presence). In this case CV is equal to 0 before the new policy is initiated and 1 afterward. A multiple regression analysis including CV will result in an indication of statistical significance connected with CV if there is an immediate or abrupt shift in whatever is being measured after the event. PPICV is a kind of dummy variable called a *post-policy intervention counter* variable. Notice that PPICV is zero until the event occurs, after which it increases by one in each successive time period. There will be an indication of statistical significance for PICV if change occurs after the introduction of a policy.

Figure 7. SYSTAT Regression Output (Excludes Graphs)



```
Dep Var: REVENUE   N: 26   Multiple R: 0.897   Squared multiple R: 0.805

Adjusted squared multiple R: 0.778   Standard error of estimate: 14.843

Effect         Coefficient    Std Error     Std Coef Tolerance     t   P(2 Tail)

CONSTANT           278.802       50.779        0.0        .       5.490    0.000
WEEKS               -1.604        1.100       -0.389     0.124   -1.458    0.159
CV                   8.549       11.696        0.138     0.248    0.731    0.473
PPICV                7.945        1.556        1.128     0.182    5.106    0.000

                             Analysis of Variance

Source              Sum-of-Squares   df  Mean-Square     F-ratio       P

Regression             19976.720     3     6658.907      30.223       0.000
Residual                4847.165    22      220.326
-------------------------------------------------------------------------------

*** WARNING ***
Case           14 is an outlier        (Studentized Residual =       -4.239)

Durbin-Watson D Statistic     2.154
First Order Autocorrelation  -0.077
```

Quick graphs and analyses; help on terms. Click on text or variable name. ESC to cancel.

Figure 7 shows a SYSTAT data screen for the multiple regression analysis interrupted time series. The P (2 Tail) column shows that the CV variable is not statistically significant. In other words, the sharp-looking, one-time downturn is not statistically significant. Space is not available to explain the logic of this finding, but any of the treatments of regression analysis cited above will allow the reader to determine that this is the case. On the other hand, the PPICV variable is statistically significant beyond any realistic doubt. The positive coefficient for this variable means that the long-term trend is upward.

Curve Smoothing and Forecasting

SYSTAT, NCSS, SPSS, and other statistics packages contain a wide variety of curve-smoothing techniques and forecasting, some of which have already been discussed in connection with spreadsheets. Generally speaking, this kind of analysis is more conveniently done in a statistics package than a spreadsheet, and statistics packages offer a greater variety of analysis techniques.

Complex Time Series Analysis

The topic of complex time series analysis was introduced earlier in the section on spreadsheets. The NCSS statistics package contains one of the easiest to use and most sophisticated complex time series analysis modules on the market, as well as the clearest documentation (Hintze, 1997b, Chaps. 74-84; Jarrett, 1987, Chaps. 3, 7-9).

DATABASE MANAGEMENT

Database management software, such as Access or Alpha-Five, is commonly used for personnel records, inventory management, or whenever large numbers of records will be stored. Database management software is also ideal when data are to be entered by a computer novice. Data input screens can be designed that include instructions for the user to help ensure that the correct types of information are keyed into particular fields. To some degree, each field can also be designed so that incorrect types of information cannot be entered. A spreadsheet can be modified in a similar fashion, but the expertise required to accomplish this is somewhat greater than is needed with a database management program, especially one intended for ease of use, such as Alpha-Five.

With database management software large numbers of records can be sorted and queried, and particular records and particular fields can be printed or exported to other software (statistics, spreadsheet) for further processing. Database management programs also are ideal for the generation of large numbers of mailing labels and form letters.

The programs mentioned above and many others are relational; they can link and draw information from two or more differently structured databases (as long as the databases have a common field) as if those databases were one (Grafton & Permaloff, 1993). This powerful feature is not shared with the other categories of software represented here.

On a recent project for a state government agency we received two data files in Excel for each of 19 counties. The files had no common column or field. We used Excel's built in LEFT and RIGHT function to extract portions of one column in one data file to create a variable/field common to one found in the second data file. We then created one merged data file for each county using Alpha Five. The Alpha Five file is in dBASE format and readable by Excel and the statistics packages we use most often. We employed Excel pivot tables and sorting commands to generate descriptive data required for the project by the federal government. The databases were exported into SYSTAT for multiple regression and other analysis, including cross-tabulation with control variables and associated statistics. Portions of the SYSTAT analysis output were saved in text format and read into WordPerfect for final report writing. The extraction option in SYSTAT allowed us to create specialized subsets of the data files quickly and easily.

Large organizations sometimes buy specialized relational databases management programs set up for their specific applications. Such programs may cost thousands, if not hundreds of thousands, of dollars to buy, install, and maintain. Often a training component is included in the installation fee. Database management programs are frequently used to store personnel records. Another function is the processing of government regulatory agency records. For example, a state regulatory board may have multiple responsibilities: licensing applicants to a profession; disciplinary functions, including the receipt of complaints and their investigation; monitoring of continuing education providers; and oversight of educational training programs. Each area would be served by different staff personnel with differing record-keeping needs. As long as each area has at least one common field ,such as social security number, as an identifier linking the databases, one set of records could be queried for information needed by another area of the organization. For example, the licensing section may need to know the current status of disciplinary actions to determine if a renewal should be granted. With relationally linked databases, licensing personnel can query the separate components of the database as if they were a single database. At the same time, access to specific fields can be granted on a need-to-know basis.

We have observed three pitfalls with database management. If standard database software is adapted by a government agency employee for use by the agency (all such software is designed to be tailored to fit specific needs), it is important that at least one other employee be taught how the customization has been implemented and backups made of the complete system and, of course, all data. If the employee who performs the customization leaves the agency and the computer on which it is running crashes, an agency can be left without access to its records or, worse yet, the records may disappear. In fact, this has happened. Events of this sort are less likely to occur if the program is sold and maintained by a commercial developer, assuming that the developer stays in business (Northrup, 2002).

Another database management pitfall is the mutation of the database over a period of years with no records kept of changes made. The original database structure may be clearly described by paper or online documentation, but incremental modifications over a period of years with no accompanying editing of the documentation can produce a database difficult for newcomers to use.

A third pitfall is a database that does not reject grossly incorrect data entries. Of course, no software can detect slight numerical mistakes in a field intended to hold numbers such as a 1 instead of a 2, for example. But, any modern database management system ought to reject such mistakes as two digit numbers entered where there should be three or letters entered where numbers are needed. A database management program should force input of data into a field containing mandatory information before allowing the user to complete follow-on fields. Database management systems that permit such mistakes will produce a database full of inaccuracies, especially when hundreds of people are keying in data.

PROJECT PLANNING AND MANAGEMENT

Project planning and management programs are designed to assist in planning and managing complex projects in terms of time schedules as well as budgets, personnel, and other resources. This category of software can be used to schedule and estimate personnel requirements and budgets for construction jobs, landscape projects, conference planning, scheduling activities in a complex lawsuit, or any other enterprise with a clearly defined beginning and end. Over the years the widely used Primavera Project Planner (P3) has received some of the most positive reviews.[2] A Google search on "project planning software" will yield many other products, some of which offer free trial downloads.

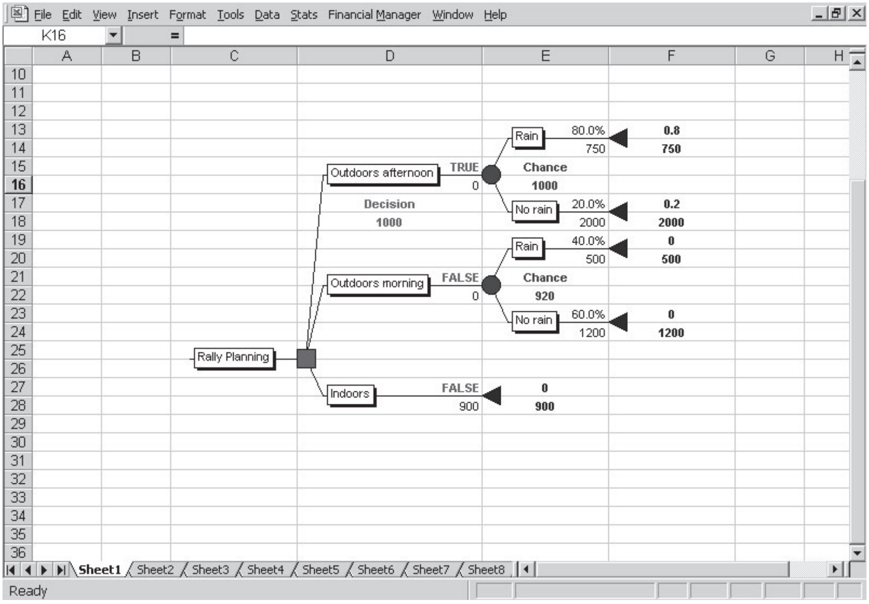
Project planning requires that a project be broken down into building blocks called activities or tasks. An activity or task is the responsibility of one person, involves one kind of work, can be scheduled, and uses the same resources from beginning to end (Primavera Systems Inc., 1999, p. 23).

Gantt charts are one of two major graphical devices used by this family of programs. A Gantt chart is a bar graph with a horizontal bar representing each task in a project. Each bar's length is proportional to the time the task requires. The beginning of a bar is located at the start date of a task, and the end of the last bar is located at the date the last task should be complete.

The Project Evaluation Review Technique (PERT) chart is the other major graphical tool used by project planning and management programs. It is a better tool for highlighting relationships among tasks, but the Gantt chart is more space-efficient, allowing more tasks to be displayed on screen or on a single sheet of paper. Programs of this sort can also display bar charts and tables showing personnel plans and budgets.

Information is entered in these programs in forms. Task names, duration, personnel, and other resources used to complete the task are keyed in by the user. Start and finish dates, personnel plans, budgets, and so forth are calculated by the software.

Figure 8. A Decision Tree



Frequently, the first draft of a project plan results in an end date that is too late. These programs automatically highlight the longest path (the critical path) in a plan where a number of tasks are being executed simultaneously. In concentrating changes on the critical path an administrator can reduce the completion time of the overall project by focusing attention where it will do the most good. Project planning and management programs are also used to monitor progress as a project is underway. Project-wide implications of early or late task completions are quickly observed.

DECISION ANALYSIS

Decision analysis is a graphical form of applied probability theory useful for analyzing situations in which uncertainty plays a part. The most common situation to which this technique is applicable has a decision maker trying to choose between two or more policies, each of which is associated with a variety of benefits and costs and probabilities that those benefits and costs will occur. In decision analysis terminology a benefit is a positive payoff and a cost is a negative payoff.

As an example, imagine a lobbying organization planning a rally near the state capital. Best attendance can be expected for an outdoor rally in the afternoon. If there is no rain, experience suggests that 2000 people can be expected, but if there is rain attendance will be only 750. In this season the probability of rain in the afternoon is 80 percent. If the rally is held outdoors in the morning and there is no rain, 1200 people can be expected, but with rain attendance will only be 500. The chance of rain in the morning is 40 percent. If the rally is held indoors at a particular location, 900 can be expected regardless of the weather. How should the rally be held?

Figure 8 shows a decision tree that presents all possible futures in this situation. This decision tree was entered and calculated in an Excel add-in called PrecisionTree, manufactured by Palisade Corporation. It is available either from the manufacturer or as a package in an excellent and reasonably priced textbook called *Data Analysis and Decision Making with Microsoft Excel* (Albright, Winston, & Zappe, 1999). This volume comes with a version of the powerful and easy-to-use simulation tool @RISK.

The decision tree is utilized by calculating the expected monetary value (EMV) of each choice. If the "Outdoors afternoon" branch of the decision tree were a game of chance run repeatedly, it would yield 750 people 80 percent of the time and 2000 people 20 percent of the time. The average for each run would be calculated as 0.8*750 + 0.2*2000 or 1000. This is the EMV. The

EMV for the other two branches are 920 and 900. In the long run the best choice in this case is the highest EMV or 1000. The rally should be held outdoors in the afternoon. Data such as the names of the branches, probabilities, and payoffs are entered in the DecisionTree program one form at a time. DecisionTree draws the decision tree and calculates the result. The program also prepares a variety of reports including a risk profile that shows in this case that there is an 80 percent chance that only 750 people will show up at the outdoor rally in the afternoon. In addition, the program allows the user to conduct sensitivity analysis to determine the effect on the result of differing payoff values (estimates of turnout numbers) and probabilities. Although our example is extremely simple, decision trees can be quite complex.

GRAPHICS FOR ILLUSTRATIONS

Illustrations often play an important part in reports, presentations, budgets, and other documents. Specialized software can be of great assistance augmenting the graphics features built into the software discussed above (Permaloff & Grafton, 1996).

Flow Charts and Organization Charts

A family of programs such as RFFlow and Visio is used to create flow charts, organization charts, and similar diagrams featuring boxes (of all shapes) and lines (solid, dotted, with or without arrowheads). Diagrams are created by the user selecting box shapes from menus, keying in labels (the boxes expand to fit labels), and connecting the boxes with lines also selected from menus. Once placed on the screen, boxes and lines can be rearranged as aesthetics and logic dictate.

The choice of programs depends on features needed, budget, and time available for learning. For example, comparing RFFlow and Visio the former is the least expensive ($64 versus $199) and by far easier to learn, but it is limited to creating flow charts and organization charts. Visio can render a greater variety of shapes, and it can be tied to powerful Visual Basic programs. Visio, like all Microsoft products, subjects the user to an intrusive online product registration process lacking in RFFlow. As with most other products discussed in this chapter, a Web search yields many other flow chart and organization chart generation programs.

We do not recommend that most public administrators attempt to employ a computer-aided design (CAD) program for occasional diagram work unless the individual is already trained in its use. CAD programs can do far more than specialized flow chart programs, but they exact an even higher price than Visio in terms of learning time, and they require many steps and much more time to complete tasks (see Permaloff & Grafton, 1996.)

Scanned Graphics

Documents can sometimes be improved with the inclusion of scanned material such as photographs. Scanners range in price from $100 to approximately $1,000, but even the least expensive are sufficient for many applications. Flatbed scanners are probably the easiest to use. The flatbed scanner resembles a small photocopy machine. The original image is placed in the scanner which generates a digitized version of the image that can be saved on disk and inserted into application programs including word processing, spreadsheet, database management, and project planning. In some cases, the image can be dragged directly from the scanning program into an application program without the need to save on disk.

SCANNED TEXT AND OPTICAL CHARACTER RECOGNITION

The scanned image of a printed page can be stored on disk for archiving purposes. This image is similar to that of a photograph of the original, including handwritten words such as signatures (see earlier discussion of scanned PDF files). Scanned text images archived on CD-R (compact disk-recordable) or CD-RW (compact disk-rewritable) consume relatively little storage space and are rated to last for 70 to 200 years if properly stored (Poor, 1998, April 21). However, it is doubtful whether in more than 15 years computers will be able to read the CD since the CD format will almost certainly be replaced by some variant of the DVD format within five years. Most DVD drives can read CDs, but it is likely that within the time span over which we would want to access archived documents the DVD format will be replaced by yet another format which will not read CDs. By comparison, consider how difficult it is becoming to find computers that accommodate 5 ¼-inch floppy disks. In normal office settings the only computers that can read such disks are 386 and some 486 machines that are virtually gone. The safest materials for long-term archiving may still be paper (which is bulky) and microfilm or microfiche.

From the perspective of the computer, scanned text is no different than the scanned image of a photograph of an automobile. Both are pictures. Word processing software is incapable of recognizing the picture of a printed page as editable text. Optical character recognition (OCR) software that works with the scanner takes the scanned image and translates it into editable text. Once the page has been scanned, the OCR process requires only another mouse click to save results to disk in a format readable by any word processor. Accuracy depends on the quality and size of the print of the original document, the complexity of the original document's layout, and the quality of the OCR software. Ordinary print found in newspapers, laser printed reports, or even photocopies of only moderate quality can be processed by OCR programs very successfully. Most scanners are sold bundled with OCR software.

OCR can be a very convenient tool. For example, the authors needed an editable version of a 24-page report written some years ago. The disk version had disappeared and might not have been saved in a format readable by our computer. The entire process of learning to use the scanner and the OCR software and generating files in the format we needed required less than one hour.

Earlier in our discussion of Web pages we noted that scanned images of text often found on the Web require a long time to download but maintain the appearance of the original printed document. If preserving the image of the original printed page with associated page numbers is not important on a website, and it is seen as desirable to minimize disk storage space and speed of downloads, OCR software can be utilized.

PRESENTATION PROGRAMS

The use of computers and computer projection hardware or large monitors for presentations continues to be popular despite the high cost of projection equipment—one of the few computer hardware components that has not dropped appreciably in price in the past several years. Although 35 mm slides, the old mainstay of presentations, are virtually gone, computer presentations are built on what might be termed virtual slides. Transparencies, another kind of slide, are still used, but they appear to be regarded as passe despite their continued practicality, readability on a larger screen, and low cost.

A computer slide may contain any combination of text and graphics, including sound and motion. A single slide may contain elements from several sources. Menu choices or built-in templates determine the background on which text and/or graphics will appear. That background can be any color or texture. Similarly, each slide's basic layout (whether there is a centered heading, bulleted text, a graphic, columns, etc.) is chosen from menus or templates. Complete mastery of some presentation programs can take many hours.

It is easy to include so many clever graphics and sound effects in a computer presentation that the audience is distracted from content or even irritated by excesses. Indeed, a former chairman of the Joint Chiefs of Staff became so annoyed with elaborate PowerPoint presentations he reportedly attempted to ban the program's use in the military.

Another drawback of slide presentations is audience boredom—a major reason some presenters employ what they hope are entertaining effects. One clever and subtle solution to the boredom problem is the use of two projectors and two screens. Image 1 appears on Screen A and then Image 2 on Screen B (with Image 1 still seen on Screen A). Image 3 then replaces Image 1 on Screen A, and so forth. This idea's effectiveness must literally be seen to be believed. It reduces boredom and eliminates the need for gimmicky dissolves from slide to slide.

GEOGRAPHIC INFORMATION SYSTEMS

Geographic (or Geographical) Information System (GIS) programs assemble, store, and display data that are specific to geographical areas such as countries, states, counties, or zip codes (www.usgs.gov/research/gis/title.html). Data might include information regarding population, economics, numbers of users of government agency services, and crime rates. Data are typically displayed in the form of maps in which geographical areas are colored or patterned to represent various levels of whatever is being measured (Orford, Harris, & Dorling, 1999; Garson & Vann, 2001; Vann & Garson, 2001).

Some GIS programs such as MapInfo are free standing, while others are attached to software such as Lotus 1-2-3 or Visio. GIS packages vary widely in terms of file formats, data manipulation features, display capabilities, and price, so considerable research is required to make an informed purchasing decision.[3] A comprehensive list of resources including GIS programs, boundary files, and data files is available at the website of the Department of Geography, University of Edinburgh: www.geo.ed.ac.uk/home/giswww.html.

CONCLUSIONS

It is difficult to imagine a job in government involving computer usage that would not benefit from the use of software tools beyond a word processing program and a Web browser.

Those who work with numerical information for simple bookkeeping, work performance data, or virtually any other application, can improve the efficiency and effectiveness of their efforts with a spreadsheet. Statistical analysis can be performed on a spreadsheet, but a statistics package is a more efficient and powerful analytical tool.

For large databases, multiple databases that must be linked, databases that include large amounts of text, and tailor-made data input screens especially for use by computer novices, database management software is needed and often available as part of an office suite. If database management software is not already present on a computer, powerful programs may be purchased for as little as $155.

Word processing, HTML editor, spreadsheet, statistics, and database management programs are the basic components of a government agency software toolkit. They are the equivalent of a hammer, drill, screwdriver set, saw, and pliers in a cabinet builder's toolkit. Beyond these basic tools are others such as presentation, graphics, scheduling, and OCR programs that are near-necessities for particular individuals, depending on the jobs at hand.

Almost any task employing a computer can be accomplished more efficiently with a variety of tools rather than any single tool, and those tools can often be had for very little expense. With two exceptions in each category we discussed above, very useful programs can be purchased that range in price between $64 and $155. The largest exception is full versions of statistics packages that can handle databases beyond 1000 observations and include advanced statistics. Here probably the lowest priced product is NCSS without a paper manual for $400 and with a manual for $500. The other exception is spreadsheet software where Excel is rapidly becoming the only choice, but Excel is frequently available as part of the cost of a computer.

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ENDNOTES

[1] See Kent (2000, pp. 145-148) for a list of HTML editors. A Google search for HTML editors yields dozens of different products in this category.

[2] A disabled version of P3 may be obtained from the manufacturer for $50. The software is identical to the full version except that its capacity has been reduced to 65 tasks. The printed reference manual and tutorial that accompany the student version are the same as those provided with the full version. The printed tutorial would be overwhelming to those unfamiliar with the basic principles of project planning.

[3] See www.agismap.com for a simple, inexpensive, and downloadable shareware GIS program for Windows. There is a $49 registration fee.

Chapter X

Survey Research, Focus Groups, and Information Technology in Research and Practice

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ABSTRACT

The integration of computing into survey research and focus groups in research and practice in public administration and related fields is the focus of this chapter. Coverage applies to other social science disciplines as well. This chapter reviews uses of computers in computer-assisted information collection (CASIC), computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), and transferring survey research methods onto the Web. A second portion of the chapter gives special attention to continuous audience response technology (CART). An example of a citizen survey focused on growth issues combined with a focus group dealing with the same topic in Cary, North Carolina, is also discussed.

INTRODUCTION

Survey research has been a pivotal methodology for academic social science research since World War II. Today, both survey research and focus groups are integral to research and practice in public administration, education, and the social sciences (Morgan, 1998; Dillman 2000; Miller & Salkind, 2002). Simply stated, both surveys and focus groups are forms of interviewing. Focus groups are essentially group interviews (Morgan, 1998). Surveys are individual interviews typically targeted at a single respondent or unit of analysis. In the case of both focus groups and traditional survey research, the enterprise essentially relies on technique captured in a classic book in the field the "art of asking questions" (Payne, 1951). The questions that are asked constitute variables in the language of research. The purpose of asking these questions is to establish relationships between and among independent and dependent variables, while controlling for additional variables that may influence the observed relationship between the independent and dependent variables. We also typically test a series of hypotheses derived from some body of theory. The question-and-answer process integral to surveys and focus groups is also a form of measurement and, as such, is subject to errors of measurement (Miller & Kobayashi, 2000).

The types of questions asked in the fields of public administration and education are extensive. They may concern community aesthetics, growth management issues, budget priorities, education, dimensions of program effectiveness, and feedback from citizens, constituents, or customers (Miller & Kobayashi, 2000). The questions may also involve the attempt to measure some theoretical construct, for example, job satisfaction (Folz, 1996; Miller & Salkind, 2002). The traditional approach to capturing the data via the question-and-answer interviewing process previously described typically involved paper and a pencil and, hence, was called Paper and Pencil Interviewing (PAPI) (Dufour, Kaushal, & Michaud, 1997). The advent of computers promised advantages over the paper-and-pencil approach that included decreased cost and increased convenience and quality. It also promised ways to reduce some of the errors of measurement inherent in the survey research process. Many of these promises have, in fact, been realized. The application of computer-assisted survey information collection methods is the most important development in survey research in the last quarter century (Couper et al., 2002).

This chapter focuses on ways in which computers can enhance the survey research and focus groups processes and looks at this topic through the lens of research and practice in public administration and related fields. It contains a discussion of categories of software applications, rather than specific reviews of selected software applications, as they relate to survey research. For more extensive software reviews that are typically discussed down to the keystroke level, the reader is advised to consult, for example, *Social Science Computer Review* (http://www.sagepub.com). This chapter specifically reviews uses of computers in computer-assisted survey information collection methods (CASIC), computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), and survey research on the Internet (Dillman, 2000). A second portion of the chapter gives special attention to continuous audience response technology (CART). Finally, an example of a citizen survey research project focused on growth issues combined with a focus group dealing with the same topic in Cary, North Carolina, is also provided. We begin by discussing the survey research process.

THE SURVEY RESEARCH PROCESS

Survey research has been central to social science research since World War II. Currently, technological changes are giving new strength to an old workhorse. In order to understand both the real and potential impact of computers on the survey process it is necessary to understand the elements of survey research process itself. We will start by outlining the stages of the survey process and identify potential sources of measurement error inherent in survey research to set a framework for understanding how computers can assist in survey research.

All methodological techniques seek to minimize the total error of measurement in an attempt to gain some understanding about the relationship between and among variables. All fail in some important respects. Even in experimental research, relationships between variables need to be replicated many times prior to being accepted. In ex post facto research, where both the independent and dependent variables have already occurred in time (survey research is one type of ex post facto research), the measurement problems are significantly greater (Bradburn & Sudman, 1991; Lyberg et al., 1997; Groves et al., 2002). Typically, in surveys we seek to reduce total survey error in search of meaningful relationships. This total survey error is all the error that can seep into a study that affects that survey's accuracy and the ability of the survey to mirror something in the real world. This total survey error is the result of a variety of factors: sampling error, nonresponse problems, interviewer bias, biased questions, nonsampling error, and other general errors of measurement. Moreover, even well constructed, valid, and reliable survey questions offer very little depth or ability to probe when compared, for example, to a focus group (Folz, 1996; Lyberg et al, 1997; Miller & Salkind, 2002,). Moreover, what is typically reported as "error" in scientific surveys is sampling error (e.g., plus or minus three percent), which is actually only one source of error and not necessarily the largest type of error found in many surveys (Converse & Traugott, 1986). Scientific surveys are preferred, however, because many forms of error in the process can be estimated. Moreover, scientific survey research provides breadth across a number of variables that allow generalizations from a sample to a population as a result of using a sampling design based on probability theory.

The steps or stages in the survey research process provide a framework for understanding the degree to which the computer can enhance the survey process. Specifically, computing can cut costs, improve quality, and minimize some errors of measurement. These stages of the survey process are presented in various forms in research design textbooks that cover survey research (e.g., Babbie, 1990; Folz, 1996; Miller & Salkind, 2002). In the next section we provide our own summary of the steps in the survey process.

Conceptualization, Planning and Management

This is the stage in which the purposes and methods of the survey research design are defined and established, the variables are conceptualized, operational definitions are developed, scale and indexes are created, the literature is reviewed, the theoretical constructs are established, hypotheses are developed, and statistical procedures are selected. During this stage the purposes of the research (exploration, description, and explanation) are defined. The type of information required is determined (attitudinal, behavioral, demographic, etc.). Who will be surveyed and by what method (telephone, mail, Internet, or in person) is decided. Also, the research must deal with issues of nonresponse (Dillman, 2000; Groves, 2002). Moreover, a variety of logistical issues are addressed at this stage—for example, what personnel are required (field staff, technical staff, senior professional staff) and what financial resources are required (Miller & Salkind, 2002).

Arguably the most important stage in the survey research process, it is at this stage that various management decisions are made. All surveys require good management. The larger the survey the more complex the management system becomes. Failures in survey management affect total survey error. Computers can facilitate the management of surveys in the same way they impact any type of management environment through database, spreadsheet, and project software.

Sampling

The basis of scientific survey research is probability theory, which includes the concept of random selection. Random selection is typically defined as a process in which every element (typically a person in a survey) has an equal or known probability of inclusion in the sample. The ultimate goal of sampling is to secure a representative sample whose measures of central tendency and variability for critical variables are unbiased and efficient estimators of the population parameters. A specific goal of a representative sample is to acquire a sample in which no group is systematically under- or over-represented (Kish, 1995).

Since researchers seldom have exact information about population parameters, they use the logic of probability theory to make statistical inferences about the larger population predicated on a single sample, the one that they have selected for a given research project (Deming, 1950; Kish, 1995; Lyberg et al., 1997). Each sample statistic (e.g., the mean age of 1,140 members of a sample selected from the roster of the American Institute of Planners) becomes an estimate of a population parameter (e.g., the mean age of all the members of the American Institute of Planners).

The difference between a sample statistic and a population parameter is known as sampling error. The degree of precision, essentially a statistical statement about how close our estimate (sample mean age) is to the real population parameter (population mean age), can be estimated using probability theory. Usually expressed as plus or minus three, four, or five percent, precision is a measure of how much error the researcher is willing to tolerate.

In addition to tolerated error, the researcher is also interested in a statement of confidence that a given population parameter really lies within the plus or minus error range specified around the sample estimate. This is stated as the degree to which we are confident that a confidence interval (e.g., the interval on the number line from 90 to 99) actually captures the population parameter. Confidence coefficients are usually expressed as 95 percent or 99 percent, or in terms of 95 or 99 samples in 100. Sampling designs (e.g., simple random, systematic, stratified, cluster, and multistage) specify methods for selecting cases from a sampling frame in a manner that ensures that the random selection required for the application of probability theory is achieved. Finally, some sampling designs require disproportionate sampling and weighting of cases (Kish, 1995).

Designing the Survey Instrument

The essential objective in designing questions for survey research is to elicit valid and reliable responses from respondents. The questions should measure what you want them to measure and should produce results that are consistent over time. Failure to produce valid and reliable responses constitutes another potential source of error in surveys. In effect, in seeking valid and reliable responses we seek to avoid the inherent bias evident in the answer to questions similar to, "Have you stopped beating your wife?" This question illustrates one common feature of a biased question, since it channels the answer in a specific direction. In this example, the respondent incriminates himself with either a "yes" or a "no" answer.

In addition to this type of outright bias, there are other potential errors less obvious. These errors confound the ability of the researcher to interpret the response to a question by potentially changing response patterns because of the form of the question, rather than its context. According to Folz (1996), this bias may be the result of "instructions, question wording, question order, response choices, or the format of the instrument" (p. 87). We will briefly review the major categories of such errors.

Outside of sampling error, question order effects have been identified as the most frequently cited explanation for errors in surveys (Schuman & Presser, 1981). *Question order* is a general term used to describe the extent to which answers to a given question are influenced by the questions that precede them in a survey. The question order effect is typically explained as the contextual effect that can be produced by asking a series of questions that produces a frame of reference for the respondent (Bradburn & Sudman, 1991). For example, asking a series of general questions about the commitment to free speech would potentially influence responses to a question that directly followed asking whether a known communist should be allowed to speak in the public schools. Question order effects are real and have been documented empirically to affect response outcomes (Schuman & Presser, 1981). An analogous problem to that of response order is the primacy or recency effect—the tendency of the respondent to choose the first or last alternative in a response set (Schuman & Presser, 1981; Sudman & Bradburn, 1982; Schwarz & Hippler, 1991; Lyberg et al., 1997).

The two major types of questions typically employed in surveys are closed versus open. A closed question, sometimes referred to as a fixed-choice or precoded question (Schuman & Preser, 1981), provides a list of mutually exclusive and exhaustive categories to the respondent. An open question, as implied, offers the respondent the opportunity for an extended narrative.

Closed questions are subject to a response set bias, an example of which is a long series of agree or disagree questions in which the respondent initially tries earnestly to answer the questions, but who because of boredom or fatigue speeds through the rest of the questions by marking all agree or disagree.

Social desirability is another response bias that affects responses to questions that have strong social norms for compliance associated with a given response, for example, answers to questions about voting. Finally, there are very important concerns related to "non-attitudes." One empirical study found that the absence of the "Don't Know" or DK option produced attitudes about non-existent laws (Schuman & Presser, 1981):

> *Our analysis of questions about two issues unknown to the American public leads to several important conclusions. First, a substantial minority of the public—in the neighborhood of 30%—will provide an opinion on a proposed law that they know nothing about if the question is asked without the DK option. This figure is certainly lower than the "majority" some times bruited about, but it is obviously large enough to trouble those assessing attitudes or beliefs concerning public issues (p. 158).*

The fact that respondents will express attitudes about issues for which they have no knowledge has led many researchers to use screening or filter questions that determine if the respondent has any knowledge about the subject before responses about his or her attitude are solicited.

Pre-Testing the Instrument

One practical way to ensure that potential factors that ultimately can influence total survey error are minimized prior to the start of a survey is to pretest the questionnaire on a sub-sample of the population of interest. This allows the researcher to determine if there are any general problems in the instructions, wording of questions, the order of questions in terms of context effect, response set bias, or the general design or the format of the questionnaire. It is tempting to assume that these factors can be discovered without a dry run. However, experience shows that this is not so. Usually a pretest results in some modification that ultimately reduces total survey error.

Data Entry Creating the Codebook

Data is the information gathered during the survey. The case or the unit of analysis for most surveys is typically the individual respondent. The questions that constitute the survey questionnaire are variables that are usually labeled (Vasu & Palmer, 1977; Folz, 1996; Miller & Salkind, 2002). Creating the codebook is the process of assigning a unique variable name, variable descrip-

Table 1. Example of One Line of a Codebook for the Variable Gender

Field	Variable Name	Variable Description	Value	Value Label
1	Gender	Respondent's Gender	0	0 = Male
			1	1 = Female
			.	. = Missing

tion, variable width, valid values, value label, and identifying codes for both valid values and missing data. The variables have values that are measured at a given level of measurement (nominal, ordinal, interval, or ratio). These variables usually have names, descriptions, and the valid values (codes) allowed for the variable. An example of one line from a codebook is displayed for the variable gender (see Table 1).

Coding decisions also potentially affect total survey error and should be made before the survey is implemented (Folz, 1996; Groves, 2002). Both open and closed questions need a coding scheme that will provide a framework for statistical and conceptual analysis.

Data Analysis and Report Writing

The final stage in the survey process is the analysis of data and the writing of a report. Typically, the analysis process begins with getting a univariate breakdown for each variable in the survey. Each univariate breakdown usually displays a frequency distribution for the variable, which includes the variable’s name, description, values, value labels, and missing data. This is usually referred to as the machine codebook and typically breaks down the variables by valid percentages, cumulative percentages, and percentage of missing data. Simple descriptive statistics are usually produced for variables such as “age” that are continuous in nature.

Bivariate analysis compares an independent variable with a dependent variable. Multivariate analysis involves more than two variables and usually employs the concept of statistical control. Finally, the inclusion of tables, bar charts, histograms, and figures when appropriate are important elements of the final report.

COMPUTER-ASSISTED SURVEY INFORMATION COLLECTION (CASIC)

In outlining the stages in the survey research process in the previous section, we have attempted to provide a framework for understanding how computers can enhance the survey process. Specifically, how computing can cut costs, improve quality, and minimize some errors of measurement. By far, the most significant single influence on the practice of surveying today is the development of the powerful personal computer (PC) at an affordable cost. The increasing speed and efficiency of information technology and the ability to minimize errors in surveys make computers the only option. Today, many researchers and practitioners who have access to a machine with sufficient memory, a large enough hard drive, and a good graphics card can perform almost any analysis on their desktop. In fact, we are at a stage where complex survey tasks such as voice recognition and multimedia interviewing can be done at an affordable cost using PCs. Moreover, as we shall subsequently discuss, while the collection of primary or original data for most surveys on a large scale will require more infrastructure than a single PC, the analysis of primary or secondary data—data previously collected and, for example, available via the Internet—is revolutionized by the current power of desktop PCs and available software (Folz, 1996; Clark & Maynard, 1998; Couper et al., 1998; Dillman, 2000; Miller & Salkind, 2002). Finally, by using today's PCs, a thoroughly professional final report complete with first-rate graphics, statistical analysis, and tabular materials, is possible using readily available software like Microsoft Office and SPSS for Windows (http://www.spss.com) or SAS for Windows (http://www.sas.com).

In North America, computer-assisted survey information collection (CASIC) has become the general term for the integration of the computer into the collection of data from respondents, transmitting of the data to remote sites, and the post-collection analysis and processing of survey data. CASIC is an umbrella term for computer-assisted telephone and personal interviewing techniques and a variety of computer-based self-administered data collection methodologies (Couper et al., 1998). CASIC was first utilized and developed at larger university survey research programs and at various governmental agencies (Couper et al., 1998; Miller & Salkind, 2002).

Computer-assisted surveys have numerous advantages. In addition to automating the large amount of drudgework associated with manual implementation of surveys, CASIC techniques can help reduce total survey error. First of all, CASIC helps eliminate inter-interviewer bias, since the computer provides exactly the same instrument in exactly the same way each time. If desired, however, the computer can also randomly administer two ostensibly similar but differently worded instruments to test instrument validity by the split-halves method. This has both basic research and practical applications. On the one hand, it allows researchers to test empirically hypotheses about, for example, the inclusion or omission of a "don't know" response, or the inclusion of a middle position (neutral) between two polar anchor points (strongly agree, strongly disagree). As a practical matter, this feature can give the survey researcher certain control over question order and response set bias. Computer-assisted interviews allow automatic branching to further questions contingent upon the respondent's earlier answers, helping to make interviews not only more efficient but also more conversational in tone. Given that the computer does not suffer from fatigue and can search through a complex questionnaire very fast, this can reduce errors in complex branching structures common to some survey designs. While most research shows no difference in responses received for computerized versus paper-and-pencil instruments, some research has noted more extreme responses to some items with computer surveys than with paper-and-pencil surveys (Synodinos, Papacostas, & Okimoto, 1994).

Electronic data collection exhibits more stability across levels of methodological variables (Helgeson & Ursic, 1989). Kiesler and Sproull (1986), in an experimental comparison of electronic surveys compared to traditional paper-and-pencil mail surveys, found that the computer method led to more honest and detailed results. Researchers found that response set patterns to closed questions in electronic surveys when compared to response set patterns in paper-and-pencil surveys were less likely to invoke socially desirable responses. The respondents tended to choose more extreme positions, possibly suggesting greater respondent honesty.

Research has also shown that open-ended questions that allow long answers reveal more information about respondents. The recent development of computer software that creates category systems extracted from textual materials holds enormous promise for using open-ended questions. The traditional way to analyze open-ended responses in survey research is content analysis. Content analysis seeks categories of meaning from, for example, verbatim interviews of respondents. This process is complex, subjective, and can add to total survey error by producing errors related to inter-rater reliability. New software based on formal linguistic processes for analyzing categorical systems, holds great promise for formalizing the analysis of textual responses to open questions. This software requires adherence to category development principles that have been developed over time and are based on research in grammar and semantics. This software offers an empirical foundation for what has traditionally been a qualitative process. This will clearly reduce total survey error by increasing validity and reliability in the development of response sets for open questions (Litkowski, 1997).

In addition, the computer now can eliminate any interviewer bias by eliminating the interviewer. Computerized self-administered data collection (CASQ) has many forms. These include such methods as disk-by-mail (DBM), touchtone data entry (TDE), voice recognition entry (VRE), Interactive Voice Response (IVR), and a profusion of self-administered surveys on the Internet (Dillman, 2000). Fully computerized surveys eliminate coding errors that often plague manual survey research (Folz, 1996; Couper et al., 1998; Miller & Salkind, 2002). Computer-assisted data entry (CADE) systematizes the capture and data entry functions on a case-by-case basis. The computerization of survey research functions preserves anonymity, thereby improving veracity of results. It appears less threatening and more neutral to the subject. CASIC in all its forms provides more timely feedback to subjects and research sponsors alike, helps prevent interviewer bias and subject intimidation (e.g., when subjects are the sponsor's employees or students), and reduces, in many cases, overall costs of the information gathering process. Finally, it is possible with computerized surveys to measure response delay intervals, which are correlated with the faking of responses. CASIC software may thus record response latency times, compare them with norms, and branch to probe questions when latency times are outside the normalized range (George & Skinner, 1990; Synodinos, Papacostos, & Okimoto, 1994; Couper et al., 1998; Weeks, 1998; Dillman, 2000).

CASIC is currently evolving computer-based management systems that assist in the management of the survey research project. Statistics Canada, for example, has developed a computer-based case management system (CMS) that performs three main functions: (1) it routes cases for analysis during the survey process from interviewer to the head office; (2) it tracks the status of a survey at a given point in time including describing the status of interviews; and (3) it gives options to interviewers to make appointments and records specialized notes (Defour, Kaushal, & Michaud, 1997). CASIC has evolved to such a point that online codebook browsing and conversational survey analysis is now possible. The University of California at Berkeley (He & Gey, 1995) has developed a system to encourage undergraduate research. Using their codebook browser with its point-and-click features, the student can click on a particular variable such as "Catholic," and the question text window will jump to the first question with that text. The student can then select a second variable and do a cross-tabulation.

COMPUTER-ASSISTED PERSONAL INTERVIEWING (CAPI)

CAPI is computer-assisted personal interviewing, a term for methods under which the interviewer brings a portable computer on which CAPI software has been loaded to the interview site. Typically, the interviewer reads questions from it and enters responses directly. CAPI allows the respondent to be interviewed in his or her home, place of business, at the mall, etc. Completed interviews are then sent to the central office via disk or via modem for processing. Pioneered in Europe by Statistics Sweden (Lyberg, 1989) and the Netherlands Central Bureau of Statistics (Van Bastalaer et al., 1987), CAPI was developed in this country by Research Triangle Institute in North Carolina who developed a modem-based system that linked interviewers to head survey quarters. Statistics Canada has perfected a CAPI system that involves an initial in-person interview, in which over 1,000 interviewers are equipped with portable computers and conduct a Labor Force Survey at the household level. This CAPI interview is then followed by 5 telephone interviews (Dufour, Kaushal, & Michaud, 1997). Research shows CAPI is accepted by both interviewers and respondents and increases data quality, if not cost. It appears, however, that CAPI is initially more expensive than traditional paper-and-pencil interviewing (Baker, 1990; Baker, 1992, Couper et al., 1998). Virtually every major American survey organization has, or is developing, a CAPI system. CAPI is a well-established computer application with a number of specific advantages that impact data quality and the reduction of total survey error (Baker,1992):

- To reduce the time needed to collect and process survey data. Computers can help us perform all the steps to collect and process data faster. The capacity to integrate several of these steps—for example, editing, coding, data entry, cleaning, and in some cases receipt and low level sample management—into a single process reduces the elapsed time between survey design and analysis
- To exert greater control over the survey process and therefore improve the quality of the information collected. Errors, both by interviewers and respondents, can be detected more quickly and resolved, often with the help of the respondent.

- To reduce survey costs. The efficiency created by integrating formerly discrete tasks into the single step . . .eliminates the keying, the editing, and much of the costly post processing that is required for paper and pencil surveys.
- To implement more complex questionnaire designs than are possible with paper and pencil. Computers can deal with much more complex skip patterns and use previously collected information more effectively than can human beings working only with paper and pencil. (p. 146)

Multimedia applications are making their appearance in the area of computerized survey research including CAPI. These multimedia applications have both practical and measurement implications. Research Triangle Institute, for example (Cooley et al., 1996), has pioneered adding audio to the interviewing process. The process works as follows: the respondent listens to a digitally recorded version of questions and answer choices through headphones. The respondent subsequently records his or her answer directly into the computer, essentially making the process a self-interview. This technology allows maximum privacy. It has a number of applications in areas where the answers required are highly sensitive, for example, sexual behavior. It also has a number of advantages that potentially reduce total survey error. First of all, it does not require the respondent to be literate, only that he or she can hear. It allows multilingual interviewing without requiring multilingual interviewers. It allows the type of controlled branching previously mentioned; automatic range checking; and the automated production of data files for analysis. Finally, this system (hardware and software) always produces a standardized questionnaire in all languages in which it is administered (Cooley et al., 1996). This use of audio is not only innovative but has a number of potential uses that will proliferate as the technology decreases in cost and increases in quality (Couper et al., 1998).

COMPUTER-ASSISTED TELEPHONE INTERVIEWING (CATI)

Computer-assisted telephone interviewing (CATI) is a hardware and software technology that has become sufficiently inexpensive and convenient. Though CATI has been available since the early 1970s (Fink, 1983; Couper et al., 1998), it now provides a convenient and cost-effective method of obtaining interview data. Once used on minicomputers like the VAX, CATI today is implemented on microcomputers with support provided by database and statistical tools for related analyses (Crispell, 1989; Couper et al., 1998).

The advantages of CATI are several, after the initial investment in computing hardware, software, and telephone lines. Much of this infrastructure may be used for other purposes and, therefore, may not represent additional costs. CATI allows projects to be completed faster and at a lower cost, particularly in terms of labor costs. It also can deal with complex questionnaires with branching formats. Since it permits only the entry of valid codes, it reduces total survey error. It also lets the researcher immediately track the respondent's profile (Anderson & Magnan, 1995; Folz, 1996; Couper et al., 1998). Also, if respondents are properly familiarized with the method, CATI is perceived as more anonymous in nature and, hence, is better suited for obtaining candid responses. This is even truer of another form of computer-assisted survey, in which respondents enter information in voting-booth style using a computerized survey, which never asks identifying information.

CATI varies substantially with the specific software used and can be differentiated broadly between two forms: partial and full. Partial CATI still requires human telephone interviewers, but the interviewers are prompted on the computer screen with the questions to ask. They enter data directly into the survey database, thereby eliminating an extra coding step. Full CATI eliminates human interviewers altogether. This technology is sometimes called touchtone dial entry (TDE), or ATI (automated telephone interviewing). The computer poses the questions to the respondent using either voice emulation or recordings, and the respondent answers by pressing buttons on a touch-tone phone. These tones are translated by the software, and the corresponding responses are entered directly into the survey database (Werking, Tupek, & Clayton, 1988; Couper et al., 1998). TDE has been used by the Bureau of Labor Statistics to collect some of its Current Employment Statistics data.

Some advantages cited for CATI are simplification of interviewer training, closer interviewer supervision in partial CATI designs, more rapid changing of survey instruments, easier use of multiple forms, more rapid availability of data, and improved cost control and record keeping. More sophisticated uses of CATI also allow branching within a questionnaire contingent on an interviewee's responses; representation of past responses to assist in recall; online calculations using prior responses to change content of items currently being posed; and availability of standardized help screens and prompts where explication of items is desired. Other features of CATI software are sample generation from telephone databases, call scheduling (e.g., handling time zones; making call-back appointments), accepting incoming call-backs, management reports (e.g., on interviewer productivity or refusal rates), quota control in stratified designs, menu-driven questionnaire authoring systems, pretest administration and analysis, question order randomization, text insertion (e.g., the respondent's name) in item text, dynamic generation of choices (respondent-supplied information from prior items appears as choices in subsequent items), revision editing (users can back up), and handling of respondent skips and qualifiers. For an extensive discussion of CATI techniques, see Couper et al. (1998) and Couper (2000). For a discussion of optimal call scheduling with CATI, see Weeks, Kulka, and Pierson (1987) and Weeks (1988).

In addition to all the foregoing advantages, CATI systems can be used in conjunction with random digit dialing (RDD) for sampling purposes. RDD is far superior to relying on available lists such as outdated phone directories that, obviously, do not contain unlisted numbers. Recall, probability sampling requires that all sampling elements have an equal or known probability of inclusion. This assumption, along with that of an adequate response rate, are assumptions that underlie many commonly employed statistical tests. RDD is one way to reduce sampling error and increase precision, because it increases the probability that every household with a phone (regardless of whether or not it is a listed phone number) can be sampled. RDD typically begins by establishing all sampling prefixes that are isomorphic with a given geographical area (for example, 380, 467, 319, etc. for Cary, North Carolina) and then uses some randomized process to select the other four digits. As a practical matter, a number of commercial sampling services exist that will draw RDD samples for specified localities. These companies typically use an algorithm that produces sample lists of phone numbers in proportion to the number of lines in each of the prefixes in the telephone company's jurisdiction.

EMAIL AND WEB SURVEYS: USING THE INTERNET

As of this writing, highly innovative academic survey research applications exist that use the Internet for self-administered questionnaires (Berott & Mcclure, 1996; Couper et al., 1998; Dillman, 2000; Miller & Salkind, 2002). Researchers are in the early stages of developing principles for reducing total survey error for Internet surveys in terms of coverage probability sampling, measurement, and nonresponse (Dillman, 2000; Groves, 2002). Techniques currently exist both for the collection of original data and in the area of secondary analysis of survey research data on the Web. Surveys on the Internet have obvious advantages: no need for paper or postage, vastly reduced data-entry costs, and a potentially international scope. Collecting survey data on the Internet is currently evolving and, we believe, will develop at breakneck speeds in the next five years. Moreover, even though an estimated 96 percent of American homes have a telephone, telephone interviewing is becoming more and more difficult because of the high number of unlisted phone numbers, answering machines, call-blocking devices like caller identification, and the proliferation of mobile phones at the expense of land-line phones. Each of these factors has resulted in reducing response rate and impacts the ability to select a true probability sample. These facts suggest that self-administered questionnaires over the Internet will grow rapidly. Our focus in this subsequent section will be restricted to a discussion of the collection of data on the Internet for social science versus commercial purposes. We will also focus on issues related to total survey error using Internet surveys (Dillman, 2000).

Surveys using the Internet typically involve two general types: e-mail surveys and web surveys. E-mail surveys are essentially questions placed in the form of a text message. Web surveys take full advantage of modern information technology and the software to create them, which can allow the author the following options: text, color, animation, video clips, skip patterns, drop-down boxes, branching, forced-choice, open-ended questions, etc. Like most new technology, surveys on the Internet offer advantages and constraints, as Dillman (2000, p. 356) observes:

> *It is also note worthy that email address directories are not available in a way that gives all email addresses a known probability of being available for sampling. In sum, email and Web surveying of the general public is currently inadequate as a means of accessing random samples of defined populations of household and or individuals.*

The difficultly of achieving a probability sample can be eliminated for certain groups in specific situations, for example, those who have a membership roster that is complete and contains an email address for each member. Similarly, a questionnaire placed on a website for which respondents are contacted by regular mail or email and given a URL can be sufficient if it is a professional group, like the American Planning Association, for whom access to the Internet can be assumed. Finally, mixed-mode surveys employing mailed questionnaires with Internet-based surveys are also possible (Dillman, 2000).

However, like the celebrated Literary Digest survey that sampled from telephone directories during the Depression, the Internet still has a socioeconomic bias. Approximately 61% of US households have access to computers (Nielson/Net Ratings 2002). This bias must be addressed and all researchers are well advised to ask themselves: “What is my population of inference?” and, “Does every element of the sampling frame have an equal or known chance of inclusion by using the Internet?" Clearly, at this time, not every potential respondent has computer access or minimum levels of computer literacy to complete a self-administered questionnaire on the Web. There is, in fact, a "digital divide" in this nation, in other words, socioeconomic classes with less technological contact with the Internet. One recent survey found that there may even be a "rural versus urban effect" when it documented that rural college students access the Internet less often than urban students (Crews & Feinberg, 2002).

Even when respondents have access to the Internet, an equally important consideration from a questionnaire design perspective is the quality of technology at the respondent's disposal. Specifically, from the perspective of Web surveys in particular, everyone online is not viewing the questionnaire from the same quality of machine. Dillman (2000, p. 360) has a wonderful graphic that illustrates that when using a paper-and-pencil survey the designer can be assured that he and the respondent are looking at the same questionnaire. This is clearly not the case when the URL on the Web is displaying to one user a questionnaire displayed via broadband access on a given ISP on a state-of-the-art machine with a high-end graphics card, while the same questionnaire is being displayed to another respondent on a five-year-old machine via modem and telephone lines on another ISP. From a design perspective this reality may require the "least common denominator" approach to questionnaire presentation, at least for the near future.

The Munich Public Health Service has experimented with transferring traditional survey research methodology onto the Internet. They have conducted a direct/mail worldwide survey using the Internet. The focus of the survey was future risks to the world and to mankind (Swoboda et al., 1997). A random sampling procedure was employed in which two hundred newsgroups were randomly selected by the news server of the Technical University of Munich (http://news.iunformatik.tu-muenchen.de). A parsing program was employed to scan all newsgroup messages for e-mail addresses and to store those messages on a file. In this way, the researchers were able to overcome the fact that there is no complete e-mail directory of users on the Internet. All returned questionnaires were stored in a single concatenated file. Data were then converted to an SAS file for analysis.

While the substantive findings of the survey are beyond the scope of this chapter, the author's conclusions about the experiment are worthy of comment (Swoboda et al., 1997). There are between 20 and 50 million users on the Internet, and while this sampling frame of Internet users is biased toward well-educated, upper-class males, this is changing daily. Data collection on the

Internet is fast, inexpensive, capable of utilizing the multimedia capabilities of computing, and allows for the immediate processing of data. Many of the technical problems of survey research on the Internet are being streamlined as we speak. The Internet also has one additional feature. It provides the researcher with access to a worldwide group of respondents, a sampling frame that is growing daily (Swoboda et al., 1997). Clearly, we are only seeing the beginning of direct-mail using the Internet.

The National Research Center (USA) conducted an experiment using citizen surveys of community opinions about services, community politics, and quality of life. Both groups were recruited through a probability sample of street addresses. One group, however, received a paper-and-pencil questionnaire. The other group was directed to a URL to complete the survey online. While the demographics for both groups were different, the variability and means about community issues were quite similar for both groups (Miller et al., 2002).

A second major impact on survey research using the Internet is in the analysis of secondary data. Secondary data are data that were collected for a purpose other than that for which the data are currently being analyzed. This secondary analysis generally has as its purpose the presenting of new findings—findings different from those contained in the original final report. Given the costs of collecting primary data, the analysis of secondary data can be very important to public administration and educational researchers and practitioners. The ability of researchers and practitioners with a PC and a connection to the Internet to analyze large data, collected according to the strictures of a well-executed sampling design and using questions that have been constructed and pretested for the types of errors discussed in this chapter, is an exciting development. Moreover, access to these data sources is moving toward the point-and-click technology found in the Windows and Macintosh environments (Clark & Maynard, 1998).

Public opinion archives worldwide are in the process of making access to end users more user-friendly, by using tools like Java programming. Using common gateway interface (CGI) and Web browsers, the user can request pages and basic statistical analysis of archived survey data. Having data online makes it possible to pursue multiple databases from one's own PC. In addition, a variety of search engines are available to assist the researcher in locating the data they need by entering keywords and subject headings related to the research endeavor.

Many data archives, such as the Roper Center, currently provide data sets to users over the Internet using FTP (file transfer protocol). Increasingly, these online data sets can be searched at the question level, which greatly facilitates topic searches and longitudinal analysis (Clark & Maynard, 1998). Among the major data producers and data archives are the Gallup Organization (http://www.gallup.com), the National Opinion Research Center (NORC) (http://www.norc.ucchicago.edu), and the Institute for Social Research (ISR) at the University of Michigan (http://www.isr.unmich.edu).

CONTINUOUS AUDIENCE RESPONSE TECHNOLOGY (CART)

Survey research is firmly established as a major tool of social scientists. Now the focus group is coming of age. Focus groups are currently used by academics, pollsters, market researchers, and educators, as well as federal, state, and local governments (Morgan, 1998). The format of a focus group involves a moderator, a group of 6 to 14 subjects who may be compensated for their time, and an organized theme or objective about which the group is gathered. For example, one of the authors of this paper recently moderated a focus group called "Growth Issues in Cary, North Carolina."

Focus groups are regarded as forms of qualitative research in which the principal mode of analysis is carefully listening to what the focus group conveys to the moderator (Krueger, 1998). When done well, qualitative focus groups involve "a disciplined process, systematic steps, a defined protocol, verifiable results, and multiple feedback loops" (Krueger, 1998, p. 5). Focus groups are predicated on open-ended questions and an interactive process that allows respondents to change their position in response to the dialog in which they are participating.

The analysis of responses in traditional qualitative focus groups requires great skill in semantics and an understanding of the dimension of the problem that is being considered. A new form of instant polling for focus groups has evolved, first labeled "continuous audience response technology" (CART) by Vasu, Long, and Hughes (1990). Also called "real-time research," the emergence of CART technology and its impact on focus group methodology is the focus of this portion of the chapter.

One important distinction among research methodologies is the dimension of time and the degree of control that the experimenter has over the independent variable (Cook & Campbell, 1979). All quantitative research designs can be considered ex-post facto or quasi-experimental, except a true experimental design in which the researcher manipulates an independent variable and measures a dependent variable under conditions of physical control. Ex-post facto research underscores the inability of the researcher to manipulate the independent variable and the inability to randomly assign subjects to treatment groups. It also suggests that the independent and dependent variable have already occurred in time (Cook & Campbell, 1979; Lyberg et al., 1997). Traditionally, in survey research the inability to achieve the control to manipulate the independent variable has been seen as a necessary tradeoff, thereby gaining statistical generalization to a larger population by employing a large random sample of subjects.

Stated simply, CART technologies offer a potential bridge between the best aspects of experimental and quasi-experimental design. CART also gives new life to the time-tested qualitative focus group methodology (Krueger, 1998). CART technology is a merger of microcomputer and video technology that allows subjects to respond to a variety of continuous stimuli. CART also creates methodological options, which can overcome some of the limitations inherent in many quasi-experimental studies. A discussion of the mechanics of CART follows.

Continuous audience response systems enable subjects in a traditional focus group setting to respond to continuous stimuli (e.g., political commercial, political speeches, statements rolling up the screen with voice overlays, etc.) by turning a dial on a hand-held keypad, moving a slide, or pressing a button on their individual response devices. The responses are captured at intervals as frequent as 1/5th of a second and fed into a microcomputer with customized software designed to analyze and output the responses. The data are saved in some file format.

The sophistication of the output is a function of the sophistication of the software. The more advanced systems provide a combination of continuous curves and digital averages for demographic breakouts and immediately superimposes these data summaries on video (stimulus) tape for playback and response in a debriefing with the subjects of the focus group. A few systems offer concurrent printouts and graphics of the demographic tabulations and the subject's continuous responses. One example would be a simulated jury responding to output from a videotaped segment of a defense attorney's opening argument in a jury simulation conducted by one of the authors of this paper. Only the high-end of CART technology allows for the continuous measurement and screen display of responses in both the aggregate (all subjects), as well as for subgroups (men and women, liberals, moderates and conservatives, etc.). This technology can be conceptualized as a form of instant feedback analysis. In other words, the focus group members can have replayed back to them their own responses (in quantitative format) to any stimulus and then be probed as to why as a group (or as individuals) they responded as they did. This feature of CART allows the researcher to explore qualitatively issues that are presented in the stimulus tape. However, this quantitative probing can be based on the qualitative knowledge of the group and individual responses to the stimulus.

Some CART systems allow for a smooth, continuous response dial and a two-line screen so subjects can confirm their input with feedback in numbers and words. The response dials are calibrated for a variety of metrics (e.g., 1 to 100, 1 through 7, etc.). The keypad can be used for precise responses to demographic questions that are recorded and become the basis for the moving breakdowns that the subjects subsequently see in debriefing.

A typical CART session takes place in a focus group facility or prewired conference room. The technology is now portable enough so that one can "parachute in" with a CART system into virtually any location or use such facilities as the US Sprint rooms located across the country that allow groups to be gathered throughout the nation for simulcasts. In addition, a moderator in one time zone can run CART sessions using the video teleconferencing features of US Sprint with subjects from multiple time zones. Subjects typically sit around a table or in a theater configuration, depending on the size of the group, and are directed by a moderator (Krueger, 1998). They are given 10 minutes training on their response tasks. Demographic questions that have been typed into the computer are sent to the subjects' television monitor. The subjects respond with their hand-held input devices. Their responses become a part of an overlay tape that is created while they dial. As we mentioned previously, this overlay tape is available for immediate playback to the group. Typically, the stimulus tape has a "warm-up" tape and a "bench-mark tape," as well as the stimulus tape containing the dependent variable concepts of interest.

Subjects' explanations in their own words are an important part of this research technique. Clearly, the response of subjects to their own responses allows for greater depth in probing issues than is afforded by traditional qualitative methodologies. In addition, a CART session may produce a third tape which is an instantly edited combination of key sections of the overlay tape and a camera view of the moderator and group discussion sessions.

This combination of quantitative and qualitative approaches to measurement has validity and reliability implications worth exploring briefly. One of the reasons for the popularity of the focus group with certain researchers is the ability of a focus group to provide qualitative responses of greater depth about a variety of stimuli. The deficiency of the traditional focus group is its susceptibility to group effects, such as being dominated by opinion leaders. The

CART hand-held keypad gives the focus group member anonymity and allows the moderator, who is frequently linked to the control room by remote microphone, the information necessary to minimize the effects of the strident but unrepresentative opinion leader.

CART technology gives the researcher a great deal of knowledge with which to mitigate many of the negative aspects of group dynamics. For example, in the playback portion or debriefing of a CART session the focus group sees for itself its group mean superimposed on the stimuli, as well as a moving histogram (if available) that underscores demographic differences in responses to the stimuli. The moderator knows the group and individual responses and can use such information to direct the flow of debriefing. For example, if a gender difference is evident with respect to a segment of a commercial, the moderator can bring it to the forefront of the discussion. In traditional focus groups the moderator would not even know of such a difference and, in fact, such a difference might be subsumed by a group consensus. Moreover, an experienced researcher behind the scenes can feed questions to pose to the group based upon his or her review of the continuous data output provided by the microcomputer. This last technique allows for the discovery and probing of issues not initially in the research design.

Most sophisticated CART systems provide all data outputs in at least ASCII format, and some produce SPSS or SAS file formats. These files typically include the independent variables (focus group demographics) with the continuous responses of the subjects to the stimuli for post-session analysis. CART technology can easily accommodate 30 to 60 subjects per session per room with either multiple sequenced sessions or multiple simultaneous sessions using US Sprint rooms. These options can generate adequate sample sizes for most research designs. Finally, the permanent record provided by the videotape with the quantitative overlays provides an enduring record of the session. This feature of the technology greatly enhances many aspects of the reliability of measurement in that it allows for multiple independent judgments of the same event and variables. The development of content analysis software previously mentioned is another important analysis tool that can be used in conjunction with CART.

The availability and cost of the technology is a consideration to those in public administration and education. The technology, while becoming less costly, is still moderately expensive. Consequently its uses tend to be in the arenas of corporate and campaign research. However, the essential elements of CART involve nonproprietary technology (microcomputers and videotape recording and playback systems).

CART systems are proliferating, and their cost will continue to decrease. Some universities are currently purchasing CART systems. The cost of using CART technology alone adds approximately $1000–$4000 per focus group session. Where one falls in this range of pricing depends on the sophistication of the hardware/software configuration. This pricing may or may not include any analytical report on the session. The more sophisticated users of CART technology realize that the technology without an accompanying research design is of limited utility. CART is best conceptualized as a technology and a methodology. However, the vendors of some systems will sell or rent them to researchers devoid of any methodological assistance.

The hand-held control units that the respondents use come in a variety of forms and are in constant evolution. This is also a factor in the pricing of the system. One current type of hand-held device is a combination of a dial and alphanumeric keypad. The keypad is employed to respond to demographic questions that appear on the monitor, such as "indicate your gender, A (male), B (female)". The top portion of the device is turned in response to the stimulus. Some CART systems have only keypads. Such keypads require the user to move his attention from the stimulus in order to focus on the correct position on the keypad and pose some reliability problems. The newest version of the technology will include remote hand-held devices.

Many CART systems must deal with electronic interference such as that found near Airports. Another important difference in CART systems that is reflected in the price is how often the system samples the session (e.g., one-fifth of a second versus every two seconds).

The software that runs CART is generally proprietary and determines the quality of graphic and statistical output available at the end of the session. Some systems have a software component that will allow presentation graphics on any segment of the videotape.

A RESEARCH APPLICATION: GROWTH ISSUES IN CARY, NORTH CAROLINA

Overview of the Study

After reviewing some of the ways in which computers can be integrated into survey research and focus group processes, it is appropriate to provide an illustration of a citizen survey that uses some of the applications we have discussed in this chapter. We will briefly outline the implementation of a study designed to report to the city council on public concerns about growth issues in the community. The complete scope of the research project is beyond the scope of this article. Rather, we want to focus on the fact that this particular citizen survey was a combination of quantitative (survey research) and qualitative approaches (focus groups) and used a number of computer applications discussed in this chapter in the process.

Cary, North Carolina, a city in the Research Triangle, has experienced explosive growth in the last two decades. For years this growth was welcomed. In recent years the costs of growth have become a major public issue. In the public debate evidenced in the media and in contentious council meetings, the community appeared polarized. Recent local elections resulted in the defeat of two longtime city council members who were considered "business as usual." In their place, candidates who were perceived as favoring controlled growth were elected. The city council and a nonpartisan group commissioned one of the authors of this chapter to conduct a poll and focus groups about growth issues in Cary and to report back the results to them (Vasu, 1998).

The study developed as follows. First of all, an online DIALOG search was conducted of a number of data sets that contained research relevant to growth issues. From this a number of conceptual categories were developed and a first-draft questionnaire completed. A pretest was conducted, and it became clear that a major issue in the community, urban sprawl, lacked conceptual clarity among the respondents. It was clear that people needed a visual referent and that this would not be possible on a telephone poll.

It was decided that both a telephone poll and a focus group would be conducted. The telephone poll gave us the advantage of being able to generalize the findings, however, at the cost of any significant depth of analysis. The combination of a telephone poll along with the inclusion of a focus group compensated for many of deficiencies of both techniques when they are used independently. The telephone poll preceded and directed the content of the focus group discussion.

The Telephone Poll

The sampling frame for the telephone poll was a list of valid telephone numbers for the municipality of Cary, North Carolina. From this list, a random digit-dialing (RDD) sample was drawn. The number of valid respondents for the survey was 454. The degree of precision for the sample is as follows. The sampling error was approximately plus or minus five percent. The confidence coefficient was 95 percent, or 95 samples in 100. A comparison of the demographics of the sample with the US Census Block figures indicated that the sample was representative of the known demographic profile of the community.

The questionnaire employed in the telephone poll was designed to define current attitudes toward a variety of social, political, and economic issues inherent in the urban growth of Cary, North Carolina. The data were collected by a private firm in West Virginia using a proprietary CATI system which produced an ASCII file that was readable using SPSS for Windows, the program which produced the analyses. The final report was written using Microsoft Word (1994), and relevant tabular and graphic output from SPSS (1997) and Abode PageMaker (1996) was included.

The questionnaire was designed to analyze the image of the Cary city government as a steward of that growth through its land use growth controls. Results of research in other communities resulted in a number of findings that formed a conceptual framework relating to how citizens perceived the issues and actors relevant to high growth. The questionnaire also was designed to target issues that were identified in the public debate as both problems and good things associated with Cary's growth. Specific questions about the desirability of Cary imposing growth controls that would limit the building of houses and business in undeveloped areas were included. The respondents were also asked to rate the importance of certain factors in choosing a community to live in. A variety of transportation questions and the willingness to pay a tax increase were asked of the respondents. Finally, an overall satisfaction with the way Cary has managed its growth over the last few years was included in the questionnaire. The telephone poll was completed one week prior to the focus groups.

Focus Groups

Subjects for the focus group (N = 30) were residents of Cary of voting age who were identified by their positive response to a question asked during the interview that related to their willingness to participate in a focus group. They were chosen according to specific demographic criteria designed to achieve a representative socioeconomic mix of Cary residents. The subjects were combined into two focus groups of 15 each. Since the focus groups do not represent a true probability sample, we did not employ inferential statistics or tests of statistical significance for the focus groups as we did for the poll. We employed a content analysis methodology of the recorded audio portion of the focus group in conjunction with statistical analysis of the data provided by the telephone interview to reach the conclusions presented subsequently in our findings (Morgan & Krueger, 1998).

The two focus groups were presented a series of visual representations of the way Cary has developed and the way Cary might develop in the future—

specifically a more compact development profile. The visual representations were done by an architect on Adobe PageMaker and sent to the author as an attachment to e-mail. These visual representations were the reason that Continuous Audience Response Technology (CART) could not be employed. The static visual forms did not lend themselves to this form of continuous sampling.

The focus groups were shown architectural drawings of different forms of urban development. Form 1 characterized Cary as it is now. Among the perspectives shown was a shopping mall now and in the future. The graphic of the future of the shopping center was done by computer enhancement of development currently consistent with zoning and development policy. In addition, a number of aerial shots of suburban developments with cul-de-sacs were shown. Form 2 illustrated a more dense development pattern similar to that evident in the old downtown Cary area, as well as residential development patterns that were more mixed use with a higher residential density.

The focus groups were split about their individual preferences between Form 1 and Form 2; however, the overwhelming majority of citizens in the focus groups supported the idea of the city of Cary using developmental controls (zoning, subdivision regulations, Planned Unit Developments (PUD), etc.) to implement Form 2. The focus group participants were able to recognize that certain features of Cary's current development pattern—large lots, cul-de-sacs, and very low densities—were likely to lead to a development pattern known as urban sprawl.

Both the poll and focus groups underscored the fact that urban growth is an issue that resonates with the citizens of Cary. This issue is clearly on the forefront of the minds of the citizens. Citizens are clearly aware that rapid growth has tangible costs as well as benefits. Currently, the costs of rapid growth are seen through the lens of traffic congestion, overcrowded schools, and the loss of natural areas primarily. While Cary was perceived as a clean and well-planned community, an emerging recognition that some of these features are in jeopardy of being eroded by rapid growth was discovered. The final report was presented to the Cary City Council as both a printed document and as an oral report to an open city council meeting in April 1998.

CONCLUSION

The integration of computing into survey research and focus groups in research and practice in public administration and related fields was the focus of this chapter. We reviewed computer-assisted information collection (CASIC), computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), as well as examined these techniques from the perspective of total survey error and how to reduce it. We also gave special attention to continuous audience response technology (CART). Finally, we discussed using a focus group in combination with a traditional telephone survey.

We are at an exciting time in terms of information technology and survey research because much is available today, evolving as we speak, and we are only beginning to exploit its potential in research. While use of the Internet and the World Wide Web is still in its early stage, it is clear that as significant as the developments are that were outlined above, more are yet to come. Because of computing and related developments in telecommunications and multimedia processing, the old approaches to survey research—and how professors teach survey research—needs reexamination. Most of the developments make collection and secondary use of survey data more accessible to end users. However, with all this technology, as grand as it is, we need to keep in mind that good survey research is as much an art as a science. Specifically, it is the art of asking good questions.

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Chapter XI

Geographic Information Systems in the Public Sector

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ABSTRACT

Geographic information systems emerged in the 1970s and have become significant decision-making tools as their capabilities have been enhanced. This chapter includes a brief discussion of various GIS applications and a more detailed discussion of issues that public managers should consider when evaluating implementation of a geographic information system. GIS applications provide benefits at the basic level in terms of producing maps efficiently, at the planning level through the use of database applications, and at the management decision-making level through an ability to access relational databases for policy-level decisions. In considering the capacity of GIS in the public sector, concise definitions of the major application theories—vector and raster—are offered to provide a basic understanding of the analytical process and GIS toolkit aspects. Issues impacting GIS implementation include needs assessment, project planning, access to public records, liability issues, public and private partnerships, dissemination of information, and privacy issues. Public managers should be aware of difficulties associated with justification of costs associated with GIS implementation and that a hesitancy exists on the part of GIS program managers to share missteps and implementation failures.

GEOGRAPHIC INFORMATION SYSTEMS

The term “geographic information system” (GIS) can be traced to the 1970s when it was first used to describe a variety of techniques used to create maps as an aid in the analysis of data. This application was an outgrowth of the development of various tools such as computer-aided mapping (CAM) and computer-aided design (CAD) systems used primarily by cartographers, draftsmen, and engineers to produce detailed and accurate maps. Through the application of CAM and CAD programs, very precise maps could be drawn and updated quickly to reflect changes in infrastructure, political boundaries, and topography. Cartographers found these new techniques to be an especially efficient addition to their craft. As the use and availability of these techniques increased, other disciplines found new applications for the technology. Public agencies and private-sector organizations discovered that these applications provided the foundation for spatial analysis of geographic data stored in large databases. This application of spatial (location) analysis allowed policy analysts to display economic, demographic, and other data in graphic or map form, which enhanced their ability to understand and communicate complex relationships (Huxhold, 1991).

GIS systems involve a combination of computer hardware with a variety of software applications, trained personnel, implementation of a methodology (raster and/or vector-based), and the creation and maintenance of an extensive relational database support system. Relational databases are characterized by the ability to integrate information from one function, such as a street network, with information from a variety of other functions, such as utility services, property assessments, zoning codes, property ownership, and demographic data. A true GIS has the ability to access a large relational database and create a graphic display for almost any combination of data. This might include a map of blighted or substandard housing, attendance zones for elementary schools, land-use patterns, residential income levels, or any of a multitude of other factors. Implementation of a GIS involves a managerial commitment to data-driven decision making as an aid in reducing uncertainty. Through the incorporation of a wide variety of social, economic, physical resource, land-form, and other data into an integrated methodology, the potential exists to improve the quality of decision making in the public sector (O’Looney, 2000). The utility of GIS for decision making is directly related to the quality of information contained in the database. Inaccurate or obsolete information in the database will produce flawed maps with potentially adverse effects when used in decision making. This means that geographic information systems involve a significant long-term investment in people, hardware, software, and training as well as continuous database development and maintenance.

The rapid and continuous development of new technologies, when combined with software and database advances, creates dynamic parameters for GIS. The result is that GIS today continues to evolve and has an ever-expanding ability to incorporate a wide range of analytic techniques that were separate and distinct in the past. Database management systems (DBMS), expert systems, statistical analysis systems, network analysis systems, remote sensing, and computer-assisted design and mapping systems (CAD and CAM) are a small sample of the various techniques that are being integrated into GIS at an increasingly rapid rate. This means that the public administrator is faced with the financial and managerial challenges associated with an increasingly useful technique that will continue to consume resources as it evolves. The decision to acquire GIS technology is a two-edged sword. It will facilitate information flow, but it will also require a significant commitment of resources in future years if the system is to be maintained.

GIS BASICS FOR PUBLIC MANAGERS

Public administrators tend to be consumers of GIS analysis rather than actual analysts or experts. In this section we will examine some of the basics of data within a GIS system in order to provide a context for understanding this technology.

Level of Measurement

Just as statistical analysis systems are governed by level of measurement, so are GIS systems. The level of data governs the manner in which variables from a database can be displayed in any map that may be produced. Nominal level data in a map might include the location of a town, airport, road, river, or political boundary. Nominal data elements can be identified, but comparisons cannot be made indicating that one element is “more than” or “better than” any other element on the map. Ordinal-level data in a map might include size of the town, type of airport (local, national, international), type of road (interstate highway, main traffic artery, residential street), or size of the river (stream, navigable river). With ordinal-level data comparisons can be made indicating that one element is “more than” or “better than” any other element on the map. Ratio-level data in a map might include indicators of elevation above sea level, number of aircraft departures per day, personal income levels within an area, incidence of criminal activity, assessed valuation of property, or number of hospital beds within a health care facility. With ratio-level data relatively precise comparisons can be made between various areas on the map. For example, the incidence of crime might be twice as high in one neighborhood as compared to another, or the value of property in one neighborhood might be half that of another neighborhood in the city.

The types of questions that can be answered by GIS are governed by the level of data that have been collected and stored in the supporting databases. Public managers will find that the utility of GIS is increased when planning and effort are given to the types of data collected for future use in a graphic analysis.

Sampling

When the output of a GIS is utilized in the decision-making process, the nature and quality of information in the database has a direct impact on the quality of the analysis. One critical factor is the type of sampling that is used to create supporting databases. Databases used by GIS may be spatial in nature. A spatial database reflects data drawn from geographic areas and may contain information on physical traits, such as landforms, or socioeconomic traits, such as income level or assessed valuation. Given the costs associated with obtaining data on every element of the population, many databases tend to rely on data drawn from samples. This means that in the creation of graphic displays, areas that were not included in the sample are assigned estimated values through the use of either interpolation or extrapolation methodology.

An unstated but underlying assumption is that the information in the database accurately represents the characteristics of the area as a whole. This is best achieved when databases have been constructed using a random sampling technique. Reliance on databases that have been constructed based on convenience or some other nonrandom selection technique introduces a potentially serious threat to the validity of any graphic analysis that is produced. As consumers of GIS analysis, public managers can minimize the risk of faulty analysis with an understanding of the sampling techniques used in the construction of supporting databases.

Raster and Vector Models

GIS analysis is currently based on two models for representing spatial data, each with unique capabilities. Raster models provide analysis based on the use of cells or pixels to represent spatial areas. One value is contained in each cell, which is typically an average or dominant value for the spatial area represented. Zoning and land use patterns, vegetation coverage, soil type, and physical characteristics, such as roads, lakes, and rivers are classic applications of raster models. This model is very efficient in representing single values or traits within each cell or pixel. Raster grid cells are typically square, which has an impact on map resolution. The resolution of raster-based maps is less well defined as grid cells increase in size or the geographic area is complex in shape and not easily represented by a number of square grid cells. Raster models benefit from a requirement for relatively simple data sources and can be used for relatively quick calculations and graphic representations. Raster models do not readily accommodate complex objects or features on maps. They do provide a representation of traits that are less well defined than vector-based systems.

Vector models use a combination of points, lines, and polygons in the construction of spatial analysis. These models have the ability to incorporate multiple layers of data. The result is an ability to display a variety of attributes in a spatial analysis. Vector models both require and exploit the capabilities of relational databases in a dynamic system that links a range of types of data. The ability to represent data in complex geometric patterns results in a higher degree of resolution for vector models over raster models. Data developed by the US Census Bureau commonly known as TIGER (topologically integrated geographic encoding and referencing system) files can be incorporated into vector models. The ability of vector models to present complex objects and to link various traits into a single representation enhances the visual clarity of the final output. This visual clarity is possible only with the availability of an extensive relational database.

GIS APPLICATIONS

The literature concerning GIS contains an expansive array of public-sector applications. This is due to the fact that geography (physical, social, and political) has a profound impact on the activities of government agencies. Diverse activities such as bus transportation routes, school attendance zones, election precincts, police station siting, and infrastructure construction and maintenance have all been performed with the aid of geographic information systems. The following examples of public-sector GIS applications illustrate the utility, adaptability, and flexibility of this technique for public managers.

Emergency Services and Dispatch

GIS provides municipalities with a useful tool to monitor factors affecting public safety and advise citizens of potential threats in a timely manner. For example, Pasadena Water and Power (California) utilized its database to provide advance warnings to residents concerning potential power blackouts during a period of energy supply crisis (American City and County, 2001).

Individuals with health risks were provided with the opportunity to make alternative plans due to the use of GIS. Companies were afforded the opportunity to manage production and workforce utilization more effectively due to the advance notifications.

Minimizing dispatch and arrival time is a crucial element for emergency services such as ambulance, fire, and police units. GIS has proven to be an important tool for public agencies in improving response times (Mitchell, 1997). Such a system might typically include a relational database consisting of several different files containing telephone numbers and street addresses, property lot size and location, street and road networks, and locations of emergency service stations such as hospitals and police and fire stations. With a GIS system in place, the emergency dispatcher with a few keystrokes or mouse clicks can identify the exact location needing service, produce a map with the shortest distance for the emergency response team, and provide that information while the team is in route. For small cities this type of system can be implemented on today's desktop computers.

Land Use Planning

Urban sprawl presents a challenge to local governments in planning the delivery of public services and the impact of development on the environment. GIS models are increasingly used by local governments to understand the pattern of urban growth and its consequences (Sostek, 2001). The use of GIS has been used to provide decision makers with high-quality information for making decisions relating to land use and zoning (Aronoff, 1988). Typically, data files containing such information as geology, topography, ownership, population density, transportation networks, and commercial activity are linked to produce a variety of derived maps for analysis purposes. This spatial analysis enhances the ability of decision makers to visualize the potential impact of zoning and other land-use decisions. Another important application of GIS for local governments involves the ability to monitor and track neighborhood characteristics and property values in order to have advance indicators of social and economic distress, so as to develop preventative strategies (Heitgert, 2001; Wade, 2001).

Health-Care Planning

Geographic information systems have demonstrated considerable utility for health-care planners (Birkin, Clarke, Clarke, & Wilson, 1996; Lang, 2000). "Medical geography" is a term that reflects this application of GIS. Epidemiology, linkages between poverty and disease, and the impact of access to service on utilization are three major areas in which GIS has been used to support health-care planning activities. Geographic patterns reflecting demand for services, costs associated with service delivery, and allocation of financial and personnel resources are important elements in health-care planning (Lubenow, 2001).

Infrastructure Planning

GIS has been used as a tool for debt management associated with infrastructure planning (Hokanson, 1994). Through an extensive database of current and proposed infrastructure and other capital improvement projects containing items such as cost, projected timelines, types of improvement or construction, location, and funding mechanism, decision makers can access multiyear maps and assess the impact of growth on debt. With the inclusion of property assessment data, decision makers can evaluate the potential impact of development on tax revenues.

Political Campaigns

Novotny and Jacobs (1997) document the increasing importance of GIS in election campaigns at all levels of government. The Clinton presidential campaigns of 1992 and 1996 were heavily influenced by maps containing demographic and attitudinal data. Campaign strategy, media advertisements, and resource allocation decisions were all heavily influenced by analysis produced by geographic information systems. Political campaigns at all levels of government will be increasingly influenced by this technology. Public managers at the local level will be presented with requests for "public domain" data that will be used for explicitly partisan political purposes.

Reapportionment

The ability of GIS to integrate population data with detailed maps allows decision makers the ability to examine a variety of plans for revising political boundaries mandated by demographic changes. GIS technology allows the creation of a variety of redistricting plans for consideration in an efficient manner. While the technology facilitates the development of numerous potential political boundaries, the ultimate decision will be made in the context of political realities.

Private-Sector Applications

GIS has been used extensively by the private sector to increase operating effectiveness and efficiency. Marketing research applications allow business enterprises to map customer behaviors such as shopping frequency, residence, household income, and driving distances (Pack, 1997; Ross, 1998). This type of information enhances marketing strategies, advertising campaigns, and planning for future growth and expansion (Harder, 1997). Some examples of other applications include realignment of sales territories based on demand; employee workload and competition; real estate acquisition and management; transportation routing; and use of interactive maps on the World Wide Web for marketing purposes.

Continued GIS Development

Both public- and private-sector applications of GIS continue to expand due to the utility of this management tool (Green, 2000). Advances in computer technology in terms of processing speed and data access when combined with improvements in software create an environment in which more governmental units are able to consider adoption of geographic information systems as aids in their decision-making process. When reviewing the literature surrounding GIS, multiple examples of successful applications are documented, while examples of unsuccessful implementation efforts are somewhat rare (Ventura, 1995). There is some indication in the literature that GIS has not completely lived up to its advertised potential, and in the words of some critics, "GIS is an unfortunate diversion in our journey towards truth" (Pickles, 1995; Worral & Bond, 1997). In the following section attention will be given to issues for public managers to consider when faced with the tasks associated with developing, maintaining, and expanding a geographic information system.

ISSUES FOR PUBLIC MANAGERS

Geographic information systems have the potential to serve managers on several different levels:

- Basic Level: as a mechanism for producing maps for recordkeeping, reflecting such variables as street networks, utility networks, and land-use patterns.
- Planning: using database information to produce maps that enhance the capability of governmental units to engage in planning.
- Management Decision Making: accessing information contained in large relational databases to facilitate decision making at the operational, strategic, and policy levels.

The implementation and utilization of a GIS as an aid to the decision-making process is influenced by a variety of technical, legal, ethical, and managerial issues (Worral, 1994; Johnson, 1996; Somers, 1998).

GIS and Democracy

GIS affords public managers with the ability to access data with greater speed and to engage in a variety of analytical scenarios concerning possible courses of action. This use of technology may result in an unanticipated threat to democracy. Haque (2001) observed that the ability to control technocratic tools by the bureaucracy has the potential to "distance" societal understanding of government actions. GIS is a source of expertise and has the potential to shift power to public-sector professionals at the expense of public citizens. One possible strategy to counter this concentration of power over GIS technology has been described as "Bottom-up GIS" (Talen, 2000). GIS is becoming easier to use and with advances in technology is less costly. While GIS has traditionally been viewed as a "top-down" analytical tool used by administrative and technical professionals, it can also be utilized to increase public participation in the planning process. Under this approach, citizens are afforded the opportunity to use GIS techniques to present their own understanding relative to their own community. This could be expanded from neighborhoods, to entire cities, to counties and larger geographic areas. Technology would be made available to citizens to enhance and preserve participatory government, a democratic value.

Needs Assessment

An adequate needs assessment process is a time- and resource-consuming activity that, when conducted completely, can provide the foundation for implementation of an effective geographic information system. Information concerning system requirements for hardware, software, database requirements, human resources, and provisions for future system expansion are identified during this process. An inadequate needs assessment has the potential to create a number of problems at the implementation stage. If an emphasis is placed primarily on meeting immediate or short-term needs, inadequate hardware or software may be acquired, which severely limits system ability to meet future needs.

GIS systems have an expansive appetite for data. The needs assessment process is the point at which the time and costs associated with creating the necessary databases are established. Most governmental units find that their current databases require significant cleaning, modification, and a commitment to continuous updating if they are to serve as the foundation for a quality geographic information system. Since data acquisition and maintenance activities consume considerable financial and personnel resources, GIS implementation is heavily influenced by resource allocation decisions based on the needs assessment.

Project Planning

A geographic information system must be integrated into the operations and functions of the organization if it is to serve its intended purposes. It is at this phase that the implications concerning the impact of the system on agency procedures and functions can be assessed. Effective project planning incorporates a "top-down" view of the design and implementation process (Somers, 1998). The long-term impact of the system on routine functions, resource allocation, and agency mission should be clearly identified and the necessary commitments to accept changes in procedures and allocate support to the system be obtained.

Implementation of any system can produce unintended and unanticipated impacts on agency operations and resource consumption patterns. For example, public access to GIS output on planned capital spending for infrastructure development can impact the behaviors of real estate developers and fuel speculative land purchases. Creating and maintaining GIS databases is an expensive endeavor. Since these databases are created by public agencies, are they in the public domain, and how are they to be treated in terms of access by other public, private, and not-for-profit agencies? Effective project planning activities afford the opportunity to investigate the experiences of other agencies with GIS implementation and to establish strategies for dealing with those consequences.

Effective project planning recognizes that both the literature concerning GIS as well as GIS vendors tend to report only successful applications and experiences. Both vendors and public agencies find their interests to be better served by minimizing dissemination of information about mistakes, shortfalls, and disappointments with geographic information systems. Public managers and GIS vendors are not rewarded for implementing systems that fail to meet expectations, hence a natural tendency to emphasize and report only successes. This means that an agency considering adopting a GIS will be required to expend significant effort to identify missteps taken by other public agencies relating to GIS as well as other management innovations.

Access to "Public Records"

Policy concerning access to GIS data is largely governed by legislation dealing with access to public records in general (Johnson, 1996). Effective GIS systems are supported by extensive databases that are often created from public records that were gathered for purposes originally unrelated to the objectives and needs of the GIS system. For example, property ownership records, property assessment data, property surveys, and zoning data were traditionally collected and maintained for different purposes, and any linkage between the records was incidental. With the implementation of a geographic information system, these files may be computerized and linked for spatial analysis purposes. The extent to which an agency has an obligation to make these new databases available to citizens and private groups continues to be an issue of concern.

One approach used by public agencies is to sell GIS data on a cost-recovery basis. This allows public agencies to recover a portion of the costs associated with data collection and database creation activities. One problem with this approach involves secondary and tertiary dissemination of GIS data after it has been obtained from the public agency. In some instances contracts and licenses have been used in an effort to regulate such activities, but enforcement of any contract involving public information between a government agency and a citizen is somewhat problematic.

Liability Issues

Liability issues are related to public access in that public agencies may be required to assume some responsibility for the accuracy and quality of the data provided to secondary users. This issue of liability is increased when the agency vends the data to others even on a cost-recovery basis. Attempts to restrict assess to GIS data to "qualified" users may, in turn, raise additional liability issues. Given the litigious nature of society today, a high probability exists that public agencies will be held liable for erroneous decisions made by consumers, if those decisions were partly the product of inaccurate data.

Public and Private Partnerships

In an effort to reduce the financial burden on public agencies associated with creating and maintaining GIS databases, partnerships with the private sector have been proposed as a viable mechanism for cost sharing (Skurznski, 1998). Public agencies have access to extensive array of data but tend to operate in an environment of limited financial resources and other budgetary constraints. The private sector tends to have access to venture and investment capital but lacks the ability to access the data available to public agencies.

Proponents of partnerships between public and private agencies argue that the access to data by the public agency and the access to venture capital by the private sector provides an irresistible solution to the financial burden associated with creation of a GIS. Such partnerships are not without risks. Negotiating contracts for such a partnership can be a lengthy and expensive process. Parties may possess a range of unrealistic expectations concerning both the process and the ultimate GIS product into the partnership. Elected and other officials may mistakenly view the income from the partnership as “new revenues” suitable for any number of uses unrelated to GIS. These revenues require protection and should be allocated to the GIS project for both development and maintenance purposes.

Expectations concerning dissemination and ownership of GIS data may not be realistic. Private-sector organizations may confuse the right to possess and use data with data ownership. Due to legal constraints much of this data, even that contributed by the private partner, may ultimately be considered as in the public domain and accessible by their competitors.

Dissemination Issues

Attempts to achieve a degree of cost recovery for GIS development conflict with policies promoting open access to public information. There is little uniformity between governmental units in terms of their own policies. Some agencies are committed to open access while others have moved to implement cost recovery policies and procedures (Johnson, 1996). Considerable variation exists between local governments across the US. One consequence of this variability in policy is that private-sector consumers will continue to seek open access to GIS data rather than engage in cost-sharing partnerships whenever possible.

Differences in dissemination policy increase the difficulty in sharing data across governmental units. A city or county committed to cost recovery is understandably hesitant to share data with another governmental agency committed to open access. Prior to and after GIS implementation, attention to dissemination issues will remain on the policy agenda of the governmental unit.

Privacy Issues

Geographic information systems do raise significant issues relating to the right to privacy (Dodson, 1998). The threat to individual privacy is created by the nature of the relational databases used by GIS systems. It is not necessary for a GIS to gather new information about an individual to create a relatively accurate personal profile for any given individual. For example, property records, tax assessment data, credit card purchase information, and other demographic data can be combined to describe the behavioral patterns of neighborhoods as well as for individuals. The issue of privacy becomes increasingly important when partnerships between public agencies and private-sector companies facilitate the combination of extensive records of both a consumer-related (private) and citizen-related (public) nature.

While GIS may be viewed as a potential threat to privacy, "social surveillance" unrelated to GIS continues to expand. Video cameras are widely used for security and law enforcement purposes, and satellite photography allows detailed monitoring of a range of daily activities by nations and by individuals. Even though other threats to privacy may be largely ignored, there remains considerable concern with the impact of GIS systems on this basic right.

System Requirements and Design

Development and implementation of an effective GIS requires incorporating the perspectives drawn from all levels within an agency. In the design process, the technical, legal, managerial, and conceptual perspectives are utilized to create a system capable of providing the type of analysis necessary to support the decision-making process. A preferred sequence of events would flow as follows: GIS analysis objectives would govern selection of software, then software selection would govern selection of both hardware and personnel training. An inherent risk that public managers face is that a persuasive representative from a software vendor will influence the purchase of a less than adequate or inappropriate GIS software package and be unable to deliver the desired type of analysis.

Alternatively, public managers may be drawn to the acquisition of an alternative non-GIS program, such as a computer-aided drafting or computer-aided mapping program, due to financial and other pressures. While these types of programs can provide very accurate graphs and maps, they do not have the ability to support spatial analysis that is integral to a true geographic information system.

System design also incorporates human resource requirements. A true GIS requires significant maintenance in terms of data entry, data cleaning and verification, and data revision. In order to achieve an acceptable return on the investment in a GIS, personnel training and retention costs should be factored into the implementation. Individuals with highly developed GIS skills tend to be very marketable and capable of demanding competitive salary packages. One aspect of the system design should involve a strategy to retain skilled employees that have been trained by the agency. Failure to adequately address this personnel issue has the potential to create an ongoing training program for either the private sector or other governmental bodies.

Organizational Issues

Many of the elements associated with successful GIS implementation can be traced to the human factor—employee attitudes and values (Nedovic-Budic & Godschalk, 1996; Ventura, 1995). Bureaucratic resistance to new procedures and techniques can be attributed to a variety of factors. These include fear of change, requirements to learn potentially difficult skills, questions about procedure growing out of administrative control and authority, fear that new procedures and techniques may expose weakness and inadequacies in current operations, and concern about budgetary impacts of new projects on personnel positions.

Accordingly, effective GIS implementation strategies would be enhanced by providing some combination of the following to employees: emphasizing personal benefits which can be derived from the change; selecting or incorporating individuals with strong computer skills for the implementation; maximizing employee exposure to GIS operations before, during, and after implementation; and providing reassurances concerning potential impacts on personnel assignments, duties, and employment status.

Institutional Issues

Implementation of a GIS has the potential to impact the existing external relationships of an agency. Existing intergovernmental relationships may be changed or altered due to changes in the flow of information. These changes may be either vertical in nature (between local, state, and federal bodies) or horizontal in nature (between departments with the same governmental unit). As stated in the previous section, fear of change has the potential to be a significant factor in resisting implementation of innovative technologies. Effective implementation strategies require public managers to examine potential changes in external and internal relationships.

Communication patterns within departments may be significantly altered with the implementation of a geographic information system. Such change is the product of data being shared with diverse departments within the agency and potentially to external entities, as well. As communication patterns change, informal power structures are created, eliminated, or changed. Changes in the flow of information have potentially significant impacts on the institutional environment.

Political Support

Implementation of a geographic information system typically involves building an internal and sometimes an external political base (Budic, 1994). Securing the support of upper-level management and elected officials is typically a prerequisite in the development of a GIS. Political support ranges from the allocation of budgetary resources necessary for funding to organizational and institutional support associated with changes in the flow of information within and from the agency. Political support is necessary to overcome hesitancy in sharing information between departments and with external consumers, whether they are governmental or private-sector.

Even though GIS represents a potentially valuable advancement in technology, successful implementation requires that public managers exercise considerable political skill.

GIS Pitfalls

Public managers who implement GIS systems should be aware of common pitfalls to avoid as identified by Kent and Klosterman, (2000). A common pitfall occurs when public managers are tempted to ask GIS professionals to "zoom in" on a particular section of a map, such as a particular neighborhood, to increase detail. Map detail is a function of the database used to create the map. If the database used to create a citywide map was not constructed using "neighborhood" data, zooming in on a "neighborhood" will only change map scale, not increase details represented in the map.

Public managers, as consumers of maps produced by GIS experts, should ask a series of questions about any GIS-produced graphic. Do the maps contain sufficient information relevant to the policy question under study? Impressive maps can be produced that contain incomplete or irrelevant data. Do the maps contain excessive information that hinders utility as a decision-making tool? GIS has the capability to store and access multiple layers of information for graphic display. Managers should specify the types of information they desire in advance in order to receive a map with sufficient information. Managers should also exercise their option to secure multiple maps, each containing different information in order to avoid clutter. Managers should ask if the GIS maps are missing any necessary elements. Some of these include the map scale, a legend that identifies all map symbols, and an indicator of the sources of data used to produce the map.

Public managers will find GIS output to possess a higher degree of utility if they approach it with a critical perspective. By asking questions relating to the purpose of the map and the content of the map, the usefulness of the technology in the decision-making process will be increased.

GIS PROSPECTS FOR THE PUBLIC MANAGER

Public managers interested in developing a geographic information system should carefully evaluate the claims for benefits associated with GIS implementation. Enthusiastic supporters of GIS claim that the technology affords managers with the capacity to "reinvent local government" due to its capability to conduct spatial analysis of data (Wilson, 1995). Without challenging the utility and potential of GIS applications, two cautionary notes should be sounded.

First, the ability to justify costs associated with GIS applications for local governments can be a difficult and daunting task (Worrall, 1994). Costs associated with GIS implementation tend to be highest during development and then continue at a reduced level over the life of the system. These costs are relatively easy to assess and document. Benefits, on the other hand, tend to be more difficult to quantify and typically are produced over the life of the system after implementation. The patterns of benefits produced may be difficult to document, since GIS applications are designed to impact private-sector operations, as well as those of government. Managers should enter into the process with an understanding that hard data justifying implementation may be somewhat elusive.

Second, GIS evaluation efforts should be conducted with a sensitivity to benefits that can be measured, such as cost savings associated with records maintenance; cost savings produced by automation of previously labor-intensive mapping procedures; productivity gains associated with the adoption of new procedures; improved regulatory functions; and income generation through enhanced management of infrastructure resources. Specific benefits can be identified and procedures can be established at the point of implementation to begin the process of documenting benefits.

GIS project managers seem to be unwilling to provide detailed cost-benefit data associated with implementation some very understandable reasons. First, there may be some level of discomfort or embarrassment that the databases that support the system may be inadequate to support all of the capabilities of the system. Second, there is a hesitance to acknowledge what may be six or seven figure costs associated with consultant fees associated with implementation. And third, there may be a desire to use the information provided by the availability of GIS to generate revenues from other governmental units (Worrall, 1994).

The expectations of various participants in a GIS project tend to vary, and differences between these expectations impact on the ultimate evaluation of the usefulness of GIS in decision making (Somers, 2001). Users and public managers may have unrealistic expectations concerning costs, time frame for project completion, and a lack of appreciation for the complexities associated with creating relational databases to support a GIS project. GIS managers may unrealistically expect elected officials and public managers to have the same goals and to be equally satisfied with the same product. This means that the effectiveness of a GIS project requires that expectations of the actors be addressed in advance. This can be achieved when a GIS project is planned in advance to consider administrative, technical, and political factors. An all too common pitfall is to make the uncritical assumption that sufficient time and resources are available to complete the project within the expected timeframe.

Public managers will increase the probability of obtaining satisfactory GIS results when they

- Work with elected officials and GIS professionals to develop a GIS strategy appropriate for the issue or policy area under investigation. The expectations of various actors in the project can be addressed at this point.
- Create a plan with specified milestones to measure progress. The absence of such a component will increase the probability that the GIS project will not meet expectations.
- Provide sufficient management support to the GIS team. In the absence of management support the project may fall behind schedule or drift from the original goals that were established when the project was initiated.
- Adopt a flexible attitude toward the project. Expectations may change during the life of the project, and the organizational and political climate may change, as well. Public managers should be prepared to adapt to a range of unanticipated changes during the life of the project.

With these cautionary notes in mind, there is little doubt that geographic information systems do have significant potential to improve the operations of governmental agencies. The literature and promotional data contain a seemingly endless record of GIS success stories, and this trend is expected to continue.

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Chapter XII

Electronic Mail in the Public Workplace: Issues of Privacy and Public Disclosure

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ABSTRACT

The increasing use of electronic mail in the workplace has generated important legal questions for public organizations. The legal questions concerning e-mail in public institutions and agencies fall into two basic categories: (a) issues of employee privacy regarding e-mail messages; and (b) public access to e-mail under applicable freedom of information legislation. While the employer has broad legal grounds for reading workplace e-mail, at least if there is some legitimate business reason for doing so, employees frequently feel that such monitoring is an excessive invasion of their privacy, and the result sometimes is organizational conflict over these privacy issues. These privacy concerns have generated demands for greater protection of employee privacy in this area, and some states have responded with legislation that covers e-mail in the workplace.

Government organizations also must treat at least some of their e-mail as part of the public record, making it open to public access, but this also can lead to conflict between public administrators, who may feel that much of their e-mail represents thoughts that were not intended for public disclosure, and external groups, such as the press, who feel that all such information belongs in the public domain. State laws vary considerably in terms of how they define the types of e-mail messages that are part of the public record, some being far more inclusive than others. Given the uncertainty and confusion that frequently exist regarding these legal questions, it is essential that public organizations develop and publicize an e-mail policy that both clarifies what privacy expectations employees should have regarding their e-mail and specifies what recording keeping requirements for e-mail should be followed to appropriately retain public records.

INTRODUCTION

The increasing importance of e-mail in the workplace has generated important legal questions, so much so that most experts strongly recommend that organizations adopt explicit policies about e-mail. Public organizations in particular must be concerned about the legal ramifications of e-mail. The legal questions concerning e-mail in public institutions and agencies fall into two basic categories: (a) issues of employee privacy regarding e-mail messages; and (b) public access to e-mail under applicable freedom of information legislation. We discuss both of these topics in this article, attempting not only to outline current legal thinking in the area, but also to raise questions that public managers and policy makers should consider.

Many of the legal issues surrounding the use of e-mail are direct extensions of principles that apply to other forms of communications. In fact, much of the law that governs e-mail is not legislation that was written explicitly to cover this particular form of communication. Issues of the privacy of employee e-mail messages, for example, are analogous to issues of the privacy of employee phone calls or written correspondence. Similarly, the right of the public to have access to governmental e-mail messages is a direct extension of the right to have access to written documents. Of course, there are questions about exactly how legal principles that were established for older communication technologies should be applied to a new one, but our understanding of this topic is broadened if we appreciate the application of legal principles across communication media.

PRIVACY ISSUES

Many employees probably believe that their e-mail messages should be private. After all, most employees probably believe that it would be highly inappropriate for supervisors to listen to their phone conversations at work or to open and read their personal correspondence. By extension, employees may also feel that supervisors should not be reading their e-mail without permission, except in certain narrowly defined cases. Many employees undoubtedly use their work e-mail system to send personal messages, both internally and externally, or they may mix personal and professional items in the same message, in much the same way that both may be mixed together in a phone conversation with a colleague. Employees may believe that they are entitled to privacy in these matters, and the fact that passwords are required to access their computer accounts, and thus their e-mail, may be considered confirmation of this belief (Greengard, 1996; Dixon, 1997).

Regardless of what many employees might believe should be the case, their legal right to privacy is quite limited when it comes to e-mail messages. The possible basis for a right to privacy of e-mail messages from the scrutiny of the employer might come from several sources. First of all, the Fourth Amendment prohibits the government from unreasonable searches and seizures, and this restricts public- (but not private-) sector employers. Second, federal legislation, most notably the Electronic Communications Privacy Act of 1986, provides some protection for communications. Third, many states may have their own constitutional and statutory provisions, which may even go beyond what the US Constitution or federal laws stipulate. Finally, under common law an individual may assert a tort claim for invasion of privacy. However, the application of the above legal and constitutional principles to workplace e-mail is extremely limited, as we shall see.

The various legal protections of an individual's privacy stem from general societal beliefs that individuals are entitled to privacy. Unwanted intrusion into an individual's personal affairs violates the respect and dignity to which an individual is entitled (Adelman & Kennedy, 1995, xiii). The concept of privacy is a complex one that is not easily captured with a simple definition. Doss and Loui (1995) argue that privacy has at least three distinct meanings: confidentiality, anonymity, and solitude. Confidentiality refers to the right to keep personal information private. Anonymity refers to the absence of unwanted attention. Individuals frequently send communications (via e-mail, telephone calls, or surface mail) that are for the intended recipient only. When a third party intercepts such a communication without permission, one or both individuals suffer a loss of confidentiality, because personal or private information is divulged to others, and both suffer a loss of anonymity, as they now are the subject of undesired attention (Doss & Loui, 1995). Of course, putting these general philosophical principles into a workable legal framework can be difficult.

Fourth Amendment Protections

The Fourth Amendment protects citizens against unreasonable searches by government officials, a protection that extends to unreasonable searches of public employees by their employers. Since federal, state, and local government employees constitute about one-sixth of the labor force, this protection is relevant for a large number of employees. However, the Fourth Amendment provides only limited protection in this situation. First of all, an employee has no valid objection to a search by the employer unless the employee has a reasonable expectation of privacy in the situation, a legal principle that applies not just to e-mail, but to other aspects of the workplace (White, 1997). For example, the employee may or may not have a reasonable expectation of privacy regarding his or her desk drawers or file cabinets. In one case, the US Supreme Court ruled that a public hospital employee did have a reasonable expectation of privacy regarding the desk and file cabinets in his office (*O'Conner v. Ortega*). The Court also said, however, that such expectations would have to be determined on a case-by-case basis, depending on the particular facts of each case (Cole, 1997). The determination of whether a reasonable expectation of privacy exists would depend on a variety of factors, including the context of the search, the uses to which the searched area is put, and the societal expectation of the extent to which the area deserves protection from governmental intrusion (Prysby & Prysby, 1999).

Even if the employee is able to assert a reasonable expectation of privacy, the employer may still have a right to read the employee's e-mail messages, as the Fourth Amendment only prohibits unreasonable searches. The general rule is that a search must be reasonable both at its inception and in its scope. A search is reasonable at its inception if there are reasonable grounds to suspect that it would turn up evidence of work-related misconduct or if it is necessary for a noninvestigatory work-related purpose. A search is reasonable in its scope if the extent of the search is reasonably related to the accomplishment of the objectives of the search (Jenero & Mapes-Riordan, 1992). In order for the search to be reasonable, the employer must also conduct the search in a fashion that is designed to obtain the information without unnecessarily intruding into the individual's privacy (Cole, 1997). The Supreme Court ruled in *O'Conner* that even though the employee had a reasonable expectation of privacy regarding his file cabinets and desk drawers, the employer nevertheless had a right to search these locations because the search was not unreasonable (Cole, 1997; Cozzetto & Pedeliski, 1997). While the *O'Conner* case did not involve e-mail, the principles are clearly extendable. An employer's search of an employee's e-mail files is reasonable if the employer has a necessity or valid business reason to conduct the search (Cole, 1997; White, 1997). Such a reason would exist in a variety of circumstances. One situation would be where the employer needs to retrieve information to conduct business, such as if an important message must be obtained from an absent employee's electronic mailbox. Another possibility would be a situation where an employee was suspected of violating organizational policies or otherwise engaging in inappropriate or even illegal conduct, and where searching the individual's e-mail might reasonably provide the employer with evidence pertaining to the suspected activity.

State Protections

State and local public employees also can claim privacy rights under applicable state constitutional provisions or state statutes, which also might apply to private-sector employees. Ten states have privacy clauses in their constitutions, and most states have statutes that protect privacy in personal communications (Fitzpatrick, 1997; White, 1997; Barsook & Roemer, 1998; Prysby & Prysby, 1999, 2000). For example, the Florida constitution states that every person "has the right to be let alone and free from governmental intrusion into the person's private life except as otherwise provided herein" (Rodriquez, 1998). Provisions such as this would provide public employees with some protection against employee monitoring of their e-mail. In *Hill v. NCAA*, the California Supreme Court stated that in interpreting the California constitution a balancing test should be applied, in which the privacy interest of the individual should be weighed against governmental interests and public concerns, which is similar to the Fourth Amendment "reasonableness" test discussed above.

In recent years, some states have added legislation to deal specifically with electronic communications and/or unauthorized access to computer systems (see Perritt, 1996, and Rodriquez, 1998, for a state-by-state summary of such legislation). Several states have legislation prohibiting unauthorized access to computer systems or data, which presumably would cover e-mail (for example, see Cal. Penal Code § 502; Conn. Gen. Stat. Ann. § 53a-251; Iowa Code Ann. § 716A.2; S.C. Code Ann. § 16-16-20). However, these statutes are not specifically written for the protection of employees, and it is unclear if they could even be enforced against an employer. The statutes generally refer to the owner of the system as the enforcer of the law; because the employer is almost certain to be the system owner, employees would probably not be able to use these statutes.

Some states have enacted specific employer-employee monitoring statutes. Under Nebraska law, an employer, on the business premises, may intercept, disclose, or use electronic monitoring in the normal course of employment. The employer may not randomly monitor employees unless notice of the policy is given to the employees (Neb. Rev. Stat. § 86-702). Similarly, Colorado employers who maintain an e-mail system are required to adopt a policy on the monitoring of e-mail, including the circumstances under which monitoring may take place (Dawes & Dallas, 1997). State law in Connecticut and Delaware also requires public and private employers to give prior written notice to employees, informing them of the type of monitoring of their e-mail that may take place. The Connecticut and Delaware laws both provide for penalties for violations. Under the Delaware law, a civil penalty of $100 per violation may be imposed; in Connecticut, for the first violation, a civil penalty of $500 may be imposed, with penalties of up to $1,000 for a second offense and $3,000 for third and subsequent offenses (Conn. Gen. Stat. Ann § 31-48d; Del. Code Ann. tit. 19, § 705).

Adding statutory protections for employee e-mail privacy may be controversial in many states. For example, the California legislature passed a bill in 1999 that would have prohibited employers from inspecting or reviewing any personal electronic mail without the consent of the employee, but the governor vetoed the bill, stating that it would be an undue regulatory burden on businesses (Watson, 2001). The governor argued that there was likely to be undesirable controversy over whether proper notification was provided to the employee and that employees should understand that computers provided by the employer are for business purposes and may be monitored by the employer, particularly because employers have a legitimate need to monitor e-mail to prevent unauthorized, inappropriate, or even illegal behavior.

In addition to or in lieu of statutory requirements, many states have formulated policies that apply to public employees in the state. For example, the Arkansas policy states that users should not consider e-mail to be private or secure, as state agencies retain the right to monitor e-mail communications, with or without notice (although they will not monitor on a regular basis). The state policy requires that all employees who have access to the Internet sign a consent form or otherwise indicate acceptance of the usage and monitoring policies (Arkansas Office of Information Technology, 2002). The California state policy includes similar language and also includes a consent form to be signed by all employees, acknowledging that all e-mail may be monitored, with or without notice (California Department of Information Technology, 2000).

The Virginia state policy applicable to all state agency employees clearly states that no employee should have an expectation of privacy in "any message, file, image or data created, sent, retrieved or received by use of the Commonwealth's equipment and/or access." The policy also specifies that the state has the right to monitor any computer system, including all e-mail sent or received by state employees, and that the monitoring may take place at any time and with or without notice (Virginia Department of Human Resource Management, 2001). The Idaho governor issued an executive order in 2001 that allows state employees to use e-mail at work for occasional personal use, but with the stipulation that all e-mail messages may be subject to monitoring (Kempthorne, 2001).

Tort Law Protections

Employees, public or private, may be able to assert a violation of privacy under common law if their e-mail is monitored by their employer. Tort law varies from state to state, but in most states it is now recognized that violation of privacy torts do apply to employment situations (Fitpatrick, 1997). Invasion of privacy is a tort with four possible causes of action, two of which might apply to e-mail. The first would be an intrusion by a method objectionable to a reasonable person into affairs that an individual has a right to keep private; the second would be a public disclosure of private matters, where the disclosure is highly offensive and not of public concern (Perritt, 1996, 93; Watson, 2001).

The reasonable expectation of privacy is an essential element in common law tort claims, just as it is in cases asserting constitutional (federal or state) protections. An employee cannot claim that his or her privacy has been invaded if there was no reasonable expectation of privacy in the employment situation. With regard to e-mail at work, privacy expectations have been very narrowly defined by the courts. First of all, if the employer has a written statement that e-mail messages may be monitored, which many employers do have, the employee probably will find it very difficult to claim an expectation of privacy. Even in the absence of a written statement, it may still be difficult for an employee to assert a reasonable expectation. In fact, in one case involving a private company, *Smyth v. Pillsbury Co.*, the court ruled against an employee who sued his employer for wrongful discharge following his firing, which was based on information gathered by the employer through reading his e-mail. The court decided that the employee had no reasonable expectation of privacy despite the fact that the employer had assured employees that their e-mail messages were considered confidential items (White, 1997).

Several important cases have reaffirmed the employer's right to inspect employee e-mail. In a well-known case, *Shoars v. Epson*, an employee claimed that her employer wrongfully terminated her after she complained that her supervisor was reading employee e-mail (Adelman & Kennedy, 1995, 310-315). Her attorney also filed a companion class action invasion of privacy lawsuit, *Flanigan v. Epson*. The California Superior Court rejected the invasion of privacy claim, stating that the California statute protecting privacy of communications did not extend to e-mail at work (Adelman & Kennedy, 1995, 315). In *Bourke v. Nissan Motor Co.*, two employees sued their employer because they were terminated after their supervisor read their e-mail messages and discovered that they had been making fun of him, but the court rejected their argument that the company had violated their privacy (Cozzetto & Pedeliski, 1997). In *Bohach v. City of Reno*, the court rejected any claim of a reasonable expectation of privacy on the part of police personnel using the departmental computer system (Bramsco, 1997).

However, at least one court has recognized a cause of action for invasion of privacy based on the employer's reading of employee e-mail (*Restuccia v. Burk Technologies, Inc.*). The *Restuccia* case involved a supervisor who read subordinates' e-mail and discovered that they had a variety of nicknames for him and that they were aware of his extramarital affair. The employees were terminated, and they then filed a lawsuit claiming, among other things, invasion of privacy and wrongful discharge in violation of the public policy against invasion of privacy. The court found that there were issues of fact as to whether the employees had a reasonable expectation of privacy in their e-mail messages and whether the reading of the messages constituted an unreasonable, substantial, or serious interference with the employees' privacy. The ruling was based on a Massachusetts statute that guarantees a right to privacy and contains language analogous to that found in a common law cause of action. To date, other courts have not followed the *Restuccia* decision.

From the limited number of cases that have been decided, it appears that employees may have fewer privacy rights for e-mail than for other forms of communications. This difference may be explained in part by the fact that the employee is using the employer's computer system, and therefore the employer may be regarded as having a right to monitor what is transmitted on the system. The argument is that if the employer owns the computer, then the employer should be able to read what is stored on the computer. In most cases the employer can do so very easily and surreptitiously, making the action perhaps seem less intrusive than opening personal mail, for example. Moreover, since the e-mail messages generally are stored in a common location, such as on a network server, the employee cannot regard them in the same light as personal items stored in a desk drawer in his or her office. In addition, actual knowledge that the system is not private may be inferred. For example, the *Bourke* court cited the fact that the plaintiffs knew that their e-mail was occasionally read by individuals other than the sender and recipient as evidence that the plaintiffs had no reasonable expectation of privacy.

It also may be that the relatively newness of e-mail means that social conventions have not firmly developed in this area. While most people would regard listening in on another person's phone conversation as very impolite, perhaps the same social stigma is not attached to the reading of someone else's e-mail (Doss & Loui, 1995). Societal perceptions are important because for recovery under most privacy common law an intrusion, even if regarded as outside usual social norms, must usually be shown to be "highly offensive" to a reasonable person.

Federal Legislative Protection

The Electronic Communications Privacy Act (ECPA), enacted by Congress in 1986, attempted to extend the legal restrictions on wiretapping of phone conversations to electronic communications, providing both criminal and civil penalties for illegal interception and disclosure of protected communications (Perritt, 1996). However, the legislative history of the ECPA suggests that Congress did not intend to restrict employers from reading the e-mail of employees (Cole, 1997; Cozzetto & Pedeliski, 1997).

First of all, the ECPA does not prohibit the monitoring of communications in situations where one of the parties consents (Cole, 1997; White, 1997). Thus, if an employer has a policy stating that e-mail will be monitored, which employees were aware of and at least implicitly agreed to, that alone would appear to provide legal justification for reading of employee e-mail. However, there are employment situations where the implied consent might be questioned. For example, in a case involving telephone monitoring (*Watkins v. L. M. Berry & Co.*), the court ruled that the employee had not given consent for the monitoring of personal calls; the employer could intercept the calls to determine if they were personal or business calls, but once it was determined that they were personal, monitoring was no longer permitted (Cole, 1997; Cozzetto & Pedeliski, 1997; White, 1997). Still, even the absence of clear consent on the part of the employee does not guarantee e-mail privacy, as other provisions of the ECPA may provide employers with broad rights in this area.

The ECPA includes a system provider exemption, which essentially states that the provider of the communications system being used by employees in the ordinary course of business, which almost always will be the employer in the case of e-mail systems, has a right to intercept messages, at least if there is a legitimate business purpose for doing so (Cole, 1997; White, 1997). Moreover, the ECPA also distinguishes between intercepting a communication and accessing a stored communication, providing more latitude for the latter. This is particularly applicable to e-mail, which almost always would be accessed by the employer from stored files, rather than during transmission. Specifically, the ECPA states that restrictions on the reading of stored files do not apply to the provider of the electronic communications service (Bramesco, 1997; Cole, 1997; Perritt, 1996, 109-110). Thus, any employer who owns the computer network in which the employee e-mail messages reside could cite both the general employer-owned system exemption and the stored communications provision. The combination of these would appear to confer a very broad right to read stored e-mail, at least as far as federal law is concerned.

Interpretation of the stored communication provision may be evolving, however. For example, in *Fraser v. Nationwide Mutual Insurance Co.*, a Pennsylvania district court ruled that the ECPA protected stored e-mail messages from interception only if the messages had not already been read by the recipient (Starr & Lippner, 2001). The distinction between read and unread stored e-mail messages is one that had not been made in earlier cases. Of course, even if the stored communication provision of the ECPA is interpreted as not applying to some or all stored e-mail messages, other aspects of the legislation, such as the system provider provision, may provide the employer with protection for monitoring of employee e-mail.

While many observers have noted the limitations of the ECPA in this area, there has been little subsequent action at the federal level to provide privacy protection for employee e-mail. One attempt, legislation entitled the Privacy for Consumers and Workers Act (PCWA), was introduced into Congress in the early 1990s (Schnaitman, 1999; Wilborn, 1998). The PCWA attempted to protect employees from secret electronic monitoring in the workplace; it would have allowed employers to monitor employee e-mail, but only after informing employees of the scope and form of the monitoring and the intended use of the information collected in the course of monitoring (Schnaitman, 1999). The legislation failed to pass either house of Congress, however. Another attempt, the Notice of Electronic Monitoring Act (NEMA), was introduced into Congress in 2000. The proposed legislation would have required employers to provide their employees with prior notice of intended monitoring of e-mail, including the means and frequency of monitoring, the type of information to be obtained, and the intended use of the obtained information (Watson, 2001). The NEMA was opposed by employer groups and, like the PCWA, languished in Congress.

While the employer may be able to read the employee's e-mail, the ECPA clearly prohibits outside third parties from doing so. The same rule generally applies to state wiretap statutes. A private third party who surreptitiously accessed an e-mail conversation between two individuals would be guilty of criminal conduct, just as if that person tapped the phone conversation between two individuals. However, many experts feel that even in these cases the ECPA provides little real protection against such actions. Computer hackers are capable of breaking into the computer network of an organization and accessing stored files, including stored e-mail, perhaps far more so than people suspect (Behar, 1997). Many individuals undoubtedly feel that such a threat is extremely remote, in large part because they have nothing in their stored e-mail files that would be of interest to an outside individual. But as one expert puts it, a hacker "has to learn how to hack, and will start off by breaking into a computer system that is relatively easy to break into" (Garcia, 1996). Organizations often feel that e-mail messages do not contain the kind of sensitive information that requires elaborate security measures, so e-mail files may be left more vulnerable to external hackers than other computer files (Garcia, 1996). Hackers may often operate without great fear, either because they believe there is little chance that they will be caught, or because they do not believe that they will be severely penalized if apprehended.

Concluding Points on Employee Privacy

While recent court cases involving the monitoring of workplace e-mail have almost always upheld the right of the employer to engage in such monitoring, it would be a mistake to conclude that there are no restrictions on the extent and nature of this monitoring. The cases that have been decided have usually involved monitoring that was in some way job related. The employer was capable of making an argument that the monitoring was necessary for business purposes. Furthermore, it should be noted that in many of these cases, the employee had engaged in some sort of inappropriate or illegal behavior and simply was not very sympathetic. It is not at all clear that the courts would rule that an employer had the right to routinely read the personal e-mail messages of an individual when there was no good reason to believe that the contents of the messages were in any way job related (Cozzetto & Pedeliski, 1997).

Although employers have broad power to read the e-mail of their employees, there may be political restrictions on such behavior when it comes to the public sector. What might be tolerated if carried out in a private company could be seen as objectionable if it occurred in a public organization. There may be more concern on the part of the public, or the media, or elected officials, regarding the monitoring of e-mail in public agencies. Even though the courts might rule otherwise, there may be widespread perceptions that the Fourth Amendment prohibits e-mail monitoring of public employees, except in carefully defined situations, and these beliefs may impose practical limits on such monitoring.

Public universities in particular tend to stress the privacy of individual e-mail (Doss & Loui, 1995). For example, the University of North Carolina at Chapel Hill's Policy on the Privacy of Electronic Information specifically states that the University respects the privacy of users and does not monitor e-mail routinely (University of North Carolina at Chapel Hill, 2002). The policy does state that an employee's use of e-mail should not burden the system or interfere with the employee's job. The policy provides that e-mail will be read only for listed purposes, which include: (a) troubleshooting of hardware/software problems; (b) investigation of system misuse; (c) retrieving university-related information; (d) investigating reports of violations of law or university policy; (e) investigating reports of employee misconduct; (f) complying with legal requests for information; and (g) retrieving information in emergency services. For reading e-mail in any of the above situations other than the first two, the system administrator will need approval from the Provost and the General Counsel (University of North Carolina at Chapel Hill, 2002).

Other universities have similar policies. For example, the University of Arizona's Electronic Mail Policy contains similar restrictions on employees' use of e-mail for personal reasons and outlines situations in which an employee's e-mail may be monitored. These situations include: (a) when required by law or policy; (b) when there is a reasonable suspicion that violations of law or university policy have occurred; and (c) when required for time-dependent critical operational needs. The university will normally try to inform e-mail users about the monitoring, except when notification might be detrimental to an investigation (University of Arizona, 1998).

It should, of course, be understood that nothing prevents the recipient of an e-mail communication from divulging its contents. An individual has no reasonable expectation of privacy regarding information communicated to another person, except in some narrowly defined situations of "privileged" communications, such as between an individual and his or her attorney (Garcia, 1996). The recipient of the message is free to tell anyone, including law enforcement officials, about its contents (Sundstrom, 1998). In the case of e-mail, this could include forwarding the message to others, a common practice. Moreover, if the recipient of an e-mail message chooses to divulge its contents to third parties, those parties are equally free to disseminate the message to others. Even if the third parties received the message from the original recipient with the understanding that they would keep it confidential, they are not bound by statutory or tort law to maintain secrecy. Again, with the power to easily forward e-mail to many individuals, the divulgence of messages is a very real possibility.

EMPLOYER OBLIGATIONS TO MONITOR

Under some circumstances, the employer may have not only the right but also the responsibility to read or monitor e-mail communications. When one employee is suspected or accused of harassment by sending offensive e-mail messages to another employee, the employer's obligation to ensure that employees do not have to work in a hostile environment may require the monitoring of the employee's e-mail. If, for example, an employee is known to have sent harassing e-mail to a co-worker previously, some monitoring might be considered necessary to shield the employer from further liability. Also, employers may be concerned about potential illegal behavior, on the part of some employees, and monitoring e-mail messages may be necessary to investigate this possibility. Since employers can in some circumstances be held liable for the illegal behavior of their employees, the employer has a responsibility to monitor possible illegal actions.

Sexual Harassment and Other Civil Rights Claims

Under federal and state civil rights laws, employers may be liable for harassment occurring in the workplace unless they exercise reasonable care to prevent and correct promptly any harassing behavior. In recent years, e-mail has been introduced as evidence in sexual discrimination and other civil rights lawsuits. E-mail evidence might arise in at least two ways. First, the e-mail might be used as direct evidence of intentional discrimination, such as if an e-mail between managers explicitly stated that an employee was terminated because of his race. Second, e-mail might be used as circumstantial evidence of discrimination. For example, e-mails containing sexist or racist humor might be used as evidence of a hostile environment based on sex or race.

E-mail has been used to support claims of discrimination in several reported cases to date. In one case (*Peterson v. Minneapolis Community Development Agency*), a court overturned summary judgment for the employer by the lower court and cited the e-mail from a supervisor to a subordinate, pressing for a relationship, as one of the facts in support of the decision (Towns & Girard, 1998). In a case involving posting to an electronic bulletin board, the New Jersey Supreme Court found that postings to the board could create a hostile work environment and that if the employer had notice of the harassing postings, it had a duty to take action to stop the harassment (*Blakey v. Continental Airlines, Inc.*). In *Strauss v. Microsoft Corp.*, the plaintiff alleged that she had not been promoted because she was female. Microsoft tried to exclude evidence of e-mail messages, sent by her supervisor, that contained comments of a sexual nature. The court found that while the e-mail messages did not prove sexual discrimination, they were relevant evidence for the jury to consider.

It is unclear at this point exactly what e-mail will need to contain to support a claim of a hostile environment. Several courts have found that a few offensive e-mail messages do not create a hostile environment (*Owens v. Morgan-Stanley*, *Harley v. McCoach, Curtis v. DiMaio*). However, Michael and Lidman (2001) report an increasing tendency for courts to hold employers responsible for offensive e-mail at work, so the legal standards in this area may be evolving. Significantly, some courts have been willing to allow the introduction of e-mail evidence to demonstrate general behavior at an office. Even if the e-mail messages in question were not targeted at a particular employee, they still might be considered as evidence of a hostile workplace. Thus, distribution of sexist or racist jokes on the workplace e-mail system might qualify as creating a hostile climate, as mentioned above (See, e.g., *Autoliv ASP, Inc. v. Department of Workforce Services*; *Greenslade v. Chicago Sun-Times, Inc.*; *Yamaguchi v. United States Dept. of the Air Force*).

An employer may escape liability if an appropriate response is taken following a complaint of harassment. In a case decided under Texas law, an employer received a complaint that racially harassing e-mail was being sent over the company's e-mail system. The employer reprimanded the employees responsible for the e-mails and had two company-wide meetings to discuss appropriate use of company e-mail. The court found that the employer's prompt action relieved it of liability (Towns & Girard, 1998, citing *Daniels v. Worldcom Corp.*). Perhaps in an attempt to shield themselves from legal action, some employers are following an even stricter and more punitive policy with respect to senders of inappropriate e-mail by firing those who are found to have violated company policy. In December 1999, the *New York Times* fired more than 20 staff employees for the sending of e-mail that contained offensive material (Kurtz, 1999). In addition, a St. Louis brokerage firm, Edward Jones & Company, fired 19 employees over e-mail containing off-color jokes and pornography (Seglin, 1999). In both of these cases, the offensive e-mail was discovered following a complaint to the employer.

Some employers have adopted a more proactive policy for preventing offensive e-mail in the workplace by employing software for the routine monitoring of e-mail for offensive content. For example, PornSweeper analyzes e-mail attachments for pornographic images and blocks transmission of inappropriate messages (Swanson, 2001). Other recently developed software screens e-mail messages for obscene, racist, or otherwise offensive language (Adams, Scheuing, & Feeley, 2000). Although it is unlikely that an employer would be held liable for failing to monitor employee e-mail when there was no reason to suspect inappropriate behavior, some employers apparently have decided to take no chances in this matter. However, while these employers may feel that routine monitoring of e-mail is necessary to shield them from potential civil rights lawsuits, such monitoring might make them more vulnerable to an invasion of privacy claim (Ciapciak & Matuszak, 1998). So far, blanket monitoring of e-mail for offensive content appears to occur primarily in the private sector, perhaps because public organizations are more politically sensitive to charges of invasion of privacy, as discussed earlier.

While the obligation to prevent a hostile workplace environment applies to both public- and private-sector employees, governmental organizations may feel more vulnerable to problems in this area. In a case known to one of the authors, the head of a local government department intended to send an e-mail message containing a joke about the Catholic Church to a few friends while at work but accidentally sent it to everyone in the department. When he realized very shortly what he had done, he issued an apology. Since this was an isolated incident, and since no employee in the department had charged the department head with harassment, the matter most likely would have ended if this had been a private organization. However, one of the e-mail recipients forwarded the message to the local media, who then publicized the incident. The considerable media attention resulted in the department head feeling that he had to resign. Had this incident occurred in a private organization, the local media undoubtedly would not have regarded it as newsworthy.

Misuse of Government Property

In addition to potential liability for sexual harassment, public employers have another reason to monitor e-mail usage of their employees—the misuse of resources. Because the computers and software used by state employees are publicly owned, excessive use of e-mail for personal use could be considered a misuse of state property. Some state employee e-mail use policies have recognized this problem. For example, the Virginia policy allows for limited personal use when the use does not interfere with productivity or adversely affect the efficient operation of the computer system, among other reasons (Virginia Department of Human Resource Management, 2001). The Texas state policy provides that "Personal e-mail should not impede the conduct of state business; only incidental amounts of employee time—time periods comparable to reasonable coffee breaks during the day—should be used to attend to personal matters . . . Personal e-mail should not cause the state to incur a direct cost in addition to the general overhead of e-mail. Consequently, employees, upon receiving personal e-mail, should read it and delete it. No storage or printing of personal e-mail is permitted" (Texas Department of Information Resources, 2001). The North Carolina state policy has similar provisions, stating that e-mail may be used for personal reasons where the direct measurable cost to the public is none or is negligible and there is no negative impact on employee performance of public duties (North Carolina Information Resource Management Commission, 1996).

A recent New York case highlights a more restrictive policy for public employee use of e-mail for non-work-related reasons. In that case, *Benson v. Cuevas*, the state Education Department had an e-mail policy that prohibited the use of the department's e-mail system for unofficial purposes, except for an unwritten agreement between the department and the union that allowed limited use by union officers to schedule meetings. The employee, Darcy, used it for other union business, including mass distribution of meetings summaries and a newsletter. The department sent out an e-mail reminding all employees that e-mail was not to be used for union business and also had a meeting with Darcy in which he was informed of the department's position. When Darcy continued to use the department e-mail system to e-mail union members, the department disconnected his access to the system. Darcy then filed suit, claiming that the department had interfered with participation in union activities in violation of state law. While an Administrative Law Judge found that the department had violated the law, the Public Employee Relations Board reversed the decision, and the PERB's findings were upheld on appeal to the New York appellate court. The court stated that the department had an e-mail policy, Darcy was in violation of the policy, and therefore the termination of e-mail access did not violate state law.

Perhaps the most significant misuse of resources in a public organization or agency occurs when an employee uses resources to conduct private, for-profit, business activity. Federal, state, and local laws and policies routinely prohibit employees from using public resources for private gain. While most private-sector employers would not want their employees using company resources for external business activities, such inappropriate use of company resources would not raise any legal questions. In a public organization, however, the matter is different. Public disclosure of governmental employees using their workplace for private business activities could well result in politically damaging charges of misuse of taxpayer funds. Thus, governmental agencies may feel more of a responsibility to guard against such misuse, including making sure that the organizational e-mail system is not used to conduct personal, for-profit business, even if the cost of using the system and the time involved in these business activities are minimal. Similar concerns apply to partisan political activities.

PUBLIC ACCESS

Public organizations must contend with one important problem involving e-mail that their private-sector counterparts do not have to face. The public has some right to see the e-mail messages in a public agency. At the federal level, the 1982 Freedom of Information Act (FOIA) outlines the public's right to access written materials and documents, and e-mail communications are included in this category (Garson, 1995, 77-79). At the state level, public access will depend on the specifics of state legislation. Many states have freedom of information acts that provide for even more public access to e-mail than does the federal FOIA.

The Federal Freedom of Information Act

The FOIA stipulates that federal agencies must make public records available when requested. Government reports, notices, bulletins, newsletters, publications, and policy statements would be considered public documents. Exemptions are made for information defined as private or confidential, which would include certain aspects of personnel records, proprietary data contained in government contracts or proposals, certain criminal records, and so on. Most of the exemptions are the usual and familiar ones. Also included in the exemptions are internal communications prior to a policy decision (Garson, 1995, 78). Thus, while a policy is being discussed within an agency, the employees are free to send messages to each other, either written or via e-mail, expressing thoughts about various aspects or implications of some possible policy, and those messages are not considered part of the public record. The exemption is designed to protect only those materials bearing on the formulation or exercise of policy-oriented judgment; peripheral documents are not protected (*Ethyl Corporation v. United States E.P.A.*). To meet the exemption, the agency would need to show that the document in question is both predecisional and deliberative (*City of Virginia Beach v. United States Dept. of Commerce*).

Depending on how strictly this exemption is interpreted, it potentially could exclude a considerable amount of e-mail communication. However, in one case, *Armstrong v. Executive Office of the President*, the court ruled that the National Archive could not refuse to provide a computer tape of certain e-mail created during the Reagan administration, as these e-mail messages could qualify as public records (Hunter, 1995). Furthermore, the court ruled that the e-mail messages had to be retained in electronic form; printing and saving the hard copies was not equivalent to saving the electronic versions. The court explained that the printed version might not contain all of the information found in an electronic file, such as the headers stating who sent the message, the recipients, and any attachments.

The FOIA provides that individuals requesting information must be specific about the content of the information being requested. The request must "reasonably describe" the records sought (5 U.S.C. § 552(a)(3)(A)). Little guidance is provided as to any more exacting requirements. However, case law indicates that although the size of the request is not the test for specificity, blanket requests for all of a certain type of record are generally considered not to be sufficiently descriptive and that broad requests that would require unreasonably burdensome searches need not be fulfilled (*Sears v. Gottschalk*).

The agency may charge for providing such information, although if the information is provided to news media, only the actual duplication costs may be charged. Other organizations or individuals can be charged for the costs involved in searching for and reviewing the information that has been requested.

State Freedom of Information Laws

A recent review of state legislation found that 14 states specifically defined public records to include electronically stored information, and another 24 states had statutes that did not specifically identify electronically stored information as public records but had legislation that was broadly worded so that such information would likely be covered (Bush & Chamberlin, 2000). However, few states specifically mention e-mail in their statutes. Four states (Arizona, Colorado, Florida, and Maryland) explicitly include e-mail in the definition of public records, and one state (Mississippi) specifically excludes e-mail (Bush & Chamberlin, 2000). Thus, in many cases decisions on whether e-mail records have to be disclosed must be based on more general statutory language.

State laws sometimes provide for far more public access than does the federal FOIA. For example, the North Carolina Public Records Act defines public records far more broadly. Included in the definition of public records are internal memos and messages, electronic or otherwise, that are part of the consideration of policies or actions, not just the statements of the policies and actions (Capone, 2002). A considerable amount of e-mail might fall into this category. Colorado's open public records law contains a similar provision, including electronic mail used for public business as "correspondence" subject to the law. The Colorado law also states that e-mail is included under the law whether transmitted locally or globally and whether read, printed, or stored (Colo. Rev. Stat. Ann. §§ 24-6-402.2, 24-72-202). Therefore, as in North Carolina, it would appear that e-mail in Colorado could be broadly accessed. On the other hand, Michigan law under certain conditions, discussed below, exempts communications that are of an advisory nature and are preliminary to a final policy decision (Hunter, 1995). California law specifically provides that "writings" subject to the state inspection of public records act include any means of recording information, including material on a disk, but that law also contains an exemption for preliminary drafts and notes of a public agency (Cal. Gov't. Code §§ 6252, 6254).

The question of whether e-mail messages that are preliminary discussions of possible policies or actions qualify as public records seems especially important. E-mail frequently substitutes for the type of conversation that individuals often have in person or by telephone. Various ideas or thoughts may be put forth just to stimulate thought or explore various possibilities. In some cases, the messages may be little more than "thinking out loud." There is a valid interest in encouraging open and honest discussions of various decision options, and e-mail often is a convenient way of doing so. If government employees fear that all their e-mail messages dealing with some topic may be publicly disclosed, open and honest discussions may be discouraged, at least through e-mail. In fact, Michigan law recognizes this point, as advisory or preliminary discussions are exempt from public disclosure if the public agency shows that the public interest in encouraging frank communications outweighs the public interest in disclosure (Hunter, 1995). Connecticut law contains a similar exception (Conn. Gen. Stat. Ann. § 1-210). Other states, however, may not contain such exemptions. The Virginia Freedom of Information Act does not contain an exclusion for such preliminary types of documents, and the Colorado law contains an exemption only for the work product of an elected official (Va. Code Ann. §§ 2.1-3700 *et seq.*; Colo. Rev. Stat. Ann. § 24-72-202).

State law routinely excludes a variety of government records from public disclosure. Commonly excluded information includes individual tax records, certain law enforcement and criminal justice records, personnel information of a confidential nature, and communications made within the scope of the attorney-client relationship. Regarding e-mail, it is worth noting that in most cases a government agency could not refuse to publicly disclose e-mail communications on the grounds that personal and confidential information is commingled with the requested information. The agency would have to separate the confidential information from the public information. Moreover, if the agency has a policy that the e-mail system is to be used for business purposes, an employee may not have a valid objection to the release of his or her e-mail messages, if they fall within the scope of a public record, even if personal information is contained in some of the communications. From this perspective, a public employee may have less of a privacy right regarding his or her e-mail than a private-sector employee.

In most cases, a purely personal e-mail communication sent or received by a public employee using the workplace e-mail system would not qualify as a public record and thus would not be covered by freedom of information statutes. This point is illustrated by a recent Florida case, which is particularly significant because Florida law provides for very broad access to public records. In the case, a local newspaper sought copies of all e-mail communications between two city employees. The city allowed the employees to divide their e-mail messages into personal and public communications, and only the latter were released to the newspaper, which then sued for all of the records. A Florida court ruled that a newspaper was not entitled to all of the e-mail communications between two city employees, even though they had used the city computer system to send and receive the messages, because state law only provided for disclosure of messages that involved official government business (*Times Publishing Co. v. City of Clearwater*). In a similar case under the Ohio public records statute, a court found that internal e-mails by county employees communicating racial epithets were not public records because the e-mails were not documenting the activities of the county (*State ex rel Wilson-Simmons v. Lake County Sheriff's Department*).

As is the case with federal law, state laws generally restrict the charges that can be imposed on those who request public records. Most states specify that only the actual cost of providing the information can be imposed on those requesting the information, although what that means can vary from state to state (Bush & Chamberlin, 2000). Under North Carolina law, the government agency cannot charge more than the actual cost of providing the information, regardless of whether or not the request is made by a news organization, a provision that is more generous than the federal FOIA (N.C. Gen. Stat. § 132-6.2). This cost cannot include the time involved in complying, since that is considered part of the job definition of state employees (Capone, 2002). The agency also must supply the information in the medium chosen by the requestor, if the agency is reasonably capable of providing the records in that format (N.C. Gen. Stat. § 132-6.2). If an individual requested e-mail messages in an electronic format, then presumably the only cost that could be charged would be for the diskettes given to the individual. Other states, however, are able to impose higher fees, including charges for labor and for the amortization of computer facilities (Bush & Chamberlin, 2000).

If state law regards public records as the property of the people, it logically follows that state and local government agencies have certain obligations to retain these records, including electronic ones. This does not mean that every e-mail message must be retained. For example, North Carolina guidelines distinguish between transitory messages and those of lasting value (North Carolina Office of Archives and History, 2002). A message setting up or confirming a meeting time is clearly transitory and can be deleted after the meeting has been held. A message of lasting value must be retained for a longer period of time, either in electronic or print form. In either case, the files can be reviewed periodically, and out-of-date information discarded.

By contrast, Michigan law is far less specific regarding e-mail, and it appears that very little of the e-mail communications in a government agency would have to be retained (Hunter, 1995). It should be noted that the Michigan freedom of information act does not impose an obligation to keep records, only an obligation to make public records that have been retained; the management and budget act specifies record-keeping requirements. Thus, if e-mail communications are retained, they must be provided on request, unless they fit into one of the specifically exempted categories; but if the communications are not required to be retained, they can be destroyed and therefore unavailable for public access (Hunter, 1995).

TOWARD A MODEL E-MAIL POLICY

We conclude this discussion with an examination of possible components of an e-mail policy for an organization. All authorities in this field recommend that organizations, pubic or private, develop clear policies regarding e-mail and communicate those policies to their employees. Differences of opinion exist on what features an e-mail policy should contain, however, and we attempt to outline some of the thinking in this area.

Barsook and Roemer (1998), writing specifically for governmental organizations, recommend that employers tell their employees that the workplace e-mail system is for business use only, that e-mail may be monitored for any reason, and that employees should not expect any privacy regarding their e-mail. Similar recommendations are made by others for both public and private employers (Fitzpatrick, 1997; White, 1997; Adams, Sheuing, & Feeley, 2000). Such recommendations frequently appear in state employment law newsletters (for example, see Coie, 1999; Walker, 1999). Some attorneys even recommend that the policy appear on the computer monitor screen every time the user logs on and that the user be required to acknowledge consent in order to proceed. Others suggest that employees be required to sign a statement acknowledging the employer's e-mail policy. As earlier discussions make clear, such a policy provides the employer with almost complete protection in the event employee e-mail is monitored. Of course, many of those who recommend a policy of this nature would not recommend that employee e-mail be regularly monitored; they simply are recommending a course of action that is likely to minimize potential legal problems for an employer.

Another opinion is that employees should be given some privacy rights regarding their e-mail (Doss & Loui, 1995; Etzioni, 1999). First of all, limiting the workplace e-mail system to business use only is a substantial restriction. Many employees find it extremely convenient to use their e-mail for personal use, just as they use their workplace telephone for personal calls. While a stronger argument can be made for permitting personal telephone calls at work—urgent or even emergency calls might be necessary, for example—prohibiting personal e-mail would be a significant inconvenience that would raise several questions. What happens if an employee receives an external e-mail message of a personal nature? What if a communication between two colleagues contains both business and personal items, just as the two can easily be contained in one phone call? Should an employee be prohibited from using the workplace e-mail system for personal messages during a lunch hour or after work? Rather than completely prohibiting personal e-mail, public employers might consider appropriate guidelines for allowable personal messages. For example, personal e-mail might be permitted if it: (1) is not excessive in amount and/or does not overburden the e-mail system; (2) is not used for private business (i.e., profit-making) purposes; and (3) is not in violation of agency policies or federal or state laws.

It also may be desirable to provide employees with some privacy rights regarding their e-mail, especially if personal communications are allowed. Rather than stating that all e-mail is subject to monitoring, possible conditions for monitoring could be spelled out. Monitoring naturally would be conducted when there was some legitimate business reason for doing so, such as a situation in which there was reason to believe that the employee was violating organizational policies. In such cases, however, monitoring of e-mail should be limited in duration and scope

(Fitzpatrick, 1997). Moreover, the results of the monitoring should be kept confidential. Thus, employees should expect that their e-mail communications would not be randomly monitored without cause, but that they could be monitored under appropriate situations.

There are possible benefits from a policy that provides employees with some privacy expectations, as opposed to a policy that provides maximum legal protection for the employer. First of all, employee morale is likely to be higher. Employees do not like being distrusted. They are likely to resent monitoring of their e-mail, even if perfectly legal, just as they would object to their employer routinely searching their office. Recognizing and respecting these privacy desires undoubtedly contributes to a healthier atmosphere in the organization (Doss & Loui, 1995). Second, employees may feel freer to use e-mail for honest and open discussions when they have some privacy expectation. Encouraging such interchange is desirable, especially for public organizations. A free flow of ideas should contribute to better decisions and policies. Thus, establishing an e-mail policy that provides employees with some privacy rights can be defended on pragmatic as well as ethical grounds, and these considerations might outweigh the desire to have maximum legal protection. Some employers agree with these arguments and have established policies that permit reasonable personal use of e-mail and provide for employee privacy rights (Sipor, Ward, & Rainone, 1999).

There is almost universal agreement that an e-mail policy should contain a prohibition of obscene, hostile, threatening, or harassing communications (Cozzetto & Pedeliski, 1997; Fitzpatrick, 1997). An employee should not have any expectation of privacy for communications that contain offensive language. As we discussed earlier, the employer has certain responsibilities to maintain a workplace that is free of harassing or hostile behavior, which mandates that certain language be restricted. Suspicion of violating this policy naturally would be a valid reason for monitoring an employee's e-mail. As discussed previously, the employer's ability to monitor e-mail for prohibited content has been enhanced by the development of software designed just for such a purpose. Several programs will scan all e-mail messages and identify those that appear to contain a significant number of questionable items (Etzioni, 1999). These messages can then be scrutinized by supervisors to determine if they truly are inappropriate communications. However, such blanket monitoring of e-mail may not be well received by employees, so there is a real question as to whether this is a desirable practice.

Another important part of the e-mail policy for a public organization is a clear statement of what types of e-mail messages qualify as public records and what requirements exist to save qualifying e-mail communications. As we have noted above, there are two competing public interests here—the desire to encourage open discussion of alternatives and the desire to inform the public. Of course, government organizations must operate within established legal parameters, which may not allow much flexibility on the part of the organization. To the extent that flexibility in interpreting and implementing the laws exists, the agency or organization has to determine the proper balance between keeping e-mail private, especially communications that are advisory or preliminary to an action or decision, and providing the public with the information that legitimately should be available for scrutiny. However this is decided, an important part of the policy is to communicate to employees what the legal requirements are and what constitutes acceptable implementation of the legislation. What employees need are clear guidelines that allow them to make appropriate decisions regarding the retention of their e-mail. Given the lack of long-standing conventions in this area, there is considerable potential for confusion over how to treat e-mail communications.

To conclude, there are important legal questions surrounding e-mail in the public workplace. These questions involve issues that are not unique to e-mail, such as questions of employee privacy rights, employer obligations to provide a nondiscriminatory workplace, and public access to information. It is useful for managers to understand current legal thinking and to consider the issues involved in order to develop an appropriate and useful e-mail policy.

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Chapter XIII

World Wide Web Site Design and Use in Public Management

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ABSTRACT

The World Wide Web (Web) has been widely adopted by local governments as a way to interact with local residents. The promise and reality of Web applications are explored in this chapter. Four types of Web utilizations are analyzed—bulletin board applications; promotion applications; service delivery applications; and citizen input applications. A survey of 145 municipal and county government websites originally conducted in 1998 was replicated in 2002. These data are used to examine how local governments are actually using the Web and to examine the evolution of Web usage over the four years between the first and second survey. The chapter concludes that local governments have made progress in incorporating many of the features of the Web but that they have a long way to go in realizing its full promise.

INTRODUCTION

Not long ago, a group of "netizens"—permanent residents of cyberspace—posed a question for themselves: Technology, Yea or Nay? In a self-congratulating tone, one of them responded, "Technology is wonderfully liberating. I don't need my stockbroker or travel agent anymore. I may choose to use them for a variety of reasons, but I don't NEED them anymore. Multiply that by millions of people and you have an entire industry that could be irrelevant in the Information Age. . . . Take this even further—maybe technology at some point will make government irrelevant" (Technology, yea or nay, 1998).

Late last fall, Detective Chris Hsiung of the Mountain View, California, police department began investigating a suspicious pattern of surveillance against Silicon Valley computers. From the Middle East and South Asia, unknown browsers were exploring the digital systems used to manage Bay Area utilities and government offices. . . . Working with experts at the Lawrence Livermore National Laboratory, the FBI traced trails of a broader reconnaissance. A forensic summary of the investigation . . . said the bureau found "multiple casings of sites" nationwide. Routed through telecommunications switches in Saudi Arabia, Indonesia, and Pakistan, the visitors studied emergency telephone systems, electrical generation and transmission, water storage and distribution, nuclear power plants and gas facilities. Some of the probes suggested planning for a conventional attack . . . But others homed in on a class of digital devices that allowed remote control of services such as fire dispatch and of equipment such as pipelines. More information about those devices—and how to program them—turned up on al Qaeda computers seized this year . . . (Gellman, 2002).

We used the first anecdote to open the original version of this chapter. It illustrated the vision that some had about what the World Wide Web could do and perhaps what they hoped that it would do—reduce the costs of doing business in such spheres as travel, stock brokerage, or government. Coupled with this comes the capacity for making institutions more transparent and accessible—posting governmental information on websites so that citizens can use that information to make more informed policy choices, interact more closely with policy makers, and become more empowered.

The second anecdote illustrates some of the concerns associated with the post-September 11 use of the Web by government. Posting more information on the Web and using the Web to conduct internal and external business increases the possibility that government services can be disrupted through denial of service, Trojan horse-, virus-, or worm-type attacks (Lo, 2000, 2002; CERT/CC, 1997). Before the terrorist attacks of September 11, such disruptions were often considered almost innocent intrusions by hackers exercising their skills with nefarious but not malicious intentions. Attacks were often viewed as temporary disruptions to the normal conduct of website business—annoying but not deadly. After September 11, however, the situation may be much more serious—terrorists may be attempting to infiltrate government websites to bridge the gap between cyber attacks and physical attacks: to use the very features of government websites that Web designers publicize—ease of use, widespread availability, etc. —to stop the delivery of emergency services in time of physical terrorist attacks and so to increase the number of casualties caused by the physical attack itself.

The two anecdotes above perhaps best illustrate changes in the Web by local governments in the four years since the original appearance of this book. In the late 1990s and early 2000s, the assumptions made by many authors about the future of government use of the Web involved monotonically upward curves—offering more sophisticated services, hosting more users, moving into more efficient and effective modes of delivering services to citizens, etc. (Musso, Weare, & Hale, 2000; Layne & Lee, 2001; Waisanen, 2002). But the wholesale move to e-government is not without some kinks in these upward sloping curves. Coupled with increased security concerns after the terrorist attacks of 2001, the economic slowdown that began in 2000 and accelerated through 2001 and 2002 brought with it reduced governmental revenues, increased attention to costs, downsizing of personnel, and other belt-tightening measures, some of which have had negative impacts on the adoption and use of high technology by local governments. It is therefore uncertain that progress in the use of Web technology by local government can be assumed. The diffusion of such technology may depend both on economic and security concerns. Rather than a monotonic upward sweeping curve, we may see hill-and-valley curve with significant advances followed by plateaus and even periods of retrenchment.

This paper explores the potential of the Web as a method of information and service delivery for local governments. The paper updates a 1998 survey of local government websites with data from a second survey conducted in 2002. The two waves of survey data allow us to examine the assumption of progress that is often made by those who research such matters. Based on the results of two waves of this survey, we can discuss some major issues involved in Web application: how to establish and maintain a service delivery system on the Web, and what impacts such a system would have on the personnel and structure of a government organization and its users.

WHAT IS THE WEB?

The Web was originally introduced in 1991 by Tim Berners-Lee, a computer engineer associated with CERN, the European Particle Physics

Laboratory in Geneva, Switzerland. The Web was designed to be a place where people all over the world could come together to work by combining their knowledge in a Web of documents formatted in a nonsequential manner known as hypertext. Berners-Lee originally envisioned the Web to be much more of a collaborative environment than it has become—in fact, his original term for a Web browser was a Web "client," meaning that the individual could write as well as read in cyberspace and information would not only flow from the server to the user but also from the user to the server. As Berners-Lee said in interview with David Plotnikoff of the *San Jose Mercury*, "That collaborative environment didn't take off. . . . But I'm not settling for it. . . . When we have a collaborative medium, where people are building things together on the Web, people won't call it a Web revolution, but that might lead to a change in how we do politics, a change in how we govern, how we run organizations. That would trigger a social revolution" (Meet the Man, 1999: D3).

Berners-Lee's vision of the Web as a collaborative medium and his belief in a Web-led social revolution are shared at least in theory by a large number of those who write on cyberspace. Much has been made of the ways in which Information Technology (IT) and the Web are transforming institutions (Reschenthaler & Thompson, 1996; Fountain, 1999; Shi & Scavo, 2000). And certainly the potential of the Web to do so is evident. The Web has only a short history, but since it was made available to the Internet community, it has proven to be the most powerful and exciting innovation in information technology. The Web offers a promising future for local governments to deliver services more quickly and conveniently. First, as a menu-driven Internet tool, the Web is easy to use, even for a person with little or no computer background. By clicking a mouse on certain elements in a Web page, a viewer can jump from one document to another without knowing where the next document is located and in an order that makes most sense for him or her. Second, the information distributed on the Web can be accessed at anytime and from anywhere. Third, with the assistance of other software on a computer (called plugs-in or application helpers), information transmitted via the Web can be displayed in the form of text, graphics, audio, and video. Fourth, Web browsers (Microsoft Internet Explorer, Netscape Communicator, etc.) have bundled all other Internet tools, including electronic mail, remote operation (Telnet), and file transfers (FTP) into one package. Such incorporation has facilitated a simple straightforward access to all online information, not merely Web documents. Finally, with Common Gateway Interface (CGI) and Java technologies,[2] the Web has been equipped with interactive capacities, allowing a person browsing a Web page to interact with the person who authors the Web page.

THE WEB AND PUBLIC MANAGEMENT

The dominant philosophy in public management for many years has centered on the notion of efficiency. Public managers have been disposed to raise the productivity within the organization and reduce the costs of operation. This has compelled public managers to seek new technologies that can help them increase managerial control and productivity of individual employees. Studies show that as the computer is penetrating into every area of government operation ranging from accounting to personnel, it has been utilized to beef up office automation and data processing. This includes word processing, spreadsheet, record keeping and retrieval, graphics, scheduling, financial calculation, statistics, engineering design, expert systems, and geographic information systems (Hurley & Wallace, 1986; Hadden, 1986; McGowan & Lombardo, 1986; Kraemer & Northrop, 1989; Lan & Cayer, 1994). The computer has become indispensable to any public agency seeking a high level of efficiency.

The advent of the Web, however, has added a completely new dimension to computer applications in the public sector. In our view, this technology's most important potential is that it gives public managers an opportunity to practice a management philosophy that emphasizes more the quality of service than efficiency. Such a philosophy, introduced under names like Total Quality Management (TQM), entrepreneurial government, and customer-driven government, considers customer satisfaction rather than productivity as the top priority of good management and encourages public managers and employees to find the ways to achieve this goal (Osborne & Gaebler, 1992). Computer-based communication such as the Web holds great promise for this new preaching for at least two reasons. The first is that it permits a public agency to deliver its services more quickly and conveniently. And the second is that it gives customers the opportunity to evaluate the services and input their opinions back into some monitoring mechanism. As many scholars in public administration have long recognized, by improving government communication with the public, computer networks will help government become more open and responsive (Kraemer & King, 1986; Gorr, 1986; Vasu, 1988). As far as the Web is concerned, there are at least four specific areas of application:

Bulletin Board. This type of utilization refers to the case where a government agency maintains a website to publish online the information regarding the services it provides, the programs it runs, the policies or regulations it enforces, the names, telephone numbers, and e-mail addresses of its key personnel, job opportunities, the important events associated with the organization, etc. The information posted on the bulletin board can be used by both the agency's employees and citizens.

Promotion. This type of utilization refers to the case where a government agency maintains a website to offer a wide range of information about the city, county or region in which it is located. This includes population, economy, education, recreation, history, tourist attractions, business opportunity, and cultural events in the community. The purpose of such application is to raise the profile of the area, increase the spirit of community, and attract outsiders. Regional economic development is often the most important aspect of this use of the Web. Another important part of promotional website is a linkage to many public and private organizations— libraries, schools, hospitals, etc.—located in the area. Still another feature is an application of Geographic Information System (GIS) software which allows data to be overlaid on maps of the community.

Service Delivery. This type of utilization represents a new direction in Web application. Both bulletin board and promotion are information dissemination. Service delivery means that a government agency maintains a website to provide services to citizens online, for example, specific information on local taxes and payment for local taxes, applications for city permits and licenses. This utilization requires that the website be interactive—the viewer must be able both to view information on the computer screen and to input information to the website.

Citizen Input. This type of utilization refers to the case where a government website allows citizens to communicate with local government officials and personnel directly. This often reflects the degree of willingness on the part of government personnel to tailor the services to the needs of citizens. The highest form of such solicitation will be some kind of public forum in which citizens can express their opinions on various policy issues. Today, local governments have to decide a wide range of controversial issues concerning community development, environment protection, local taxes, cable television rates, traffic management, public health, zoning regulations, etc. Like many private companies soliciting consumers' nine preferences via the Web, government agencies can also use the Web to invite citizens to contribute their opinions on policy issues facing the community. However, unlike private companies (whose primary goal is to increase sales no matter to whom they are made), government *needs to be* concerned about the representation of those who utilize a Web page. We will take this point up later in this essay.

One can see an internal/external dimension in these four utilizations. The latter two utilizations—service delivery and citizen input—are largely directed at residents within the city. Citizens would most likely make use of the citizen input utilization. While there is no reason that a local government would (or could) limit a discussion group only to residents or would not allow nonresidents to comment on city services, websites, etc., there is also no overwhelming reason why nonresidents might be interested in becoming involved in a discussion of a local issue unless that local issue had national implications.[3] Residents, business operators, and property owners are those who would be most interested in city services and so are those who would most likely make use of the service delivery utilization. The items posted on a city's bulletin board would also be of most interest to city residents, but public hearings concerning zoning changes, for example, might be of interest to business operators and property owners outside the city. Other announcements—street closings, schedules for public buildings, etc. —would also have their own external constituencies. The promotion utilization would most likely be of the greatest interest to external constituencies. External constituencies would be interested in entertainment events, tourist attractions, business opportunities, history, recreational opportunities, and other information a city's promotional utilization would maintain. External researchers might also find the links to other institutions and the inclusion of Geographical Information System (GIS) software useful for their own purposes.

SURVEY RESULTS

To investigate the four areas of Web application described above, we conducted surveys of local government websites listed on the Public Technology, Inc. Web page (http://www.pti.nw.dc.us/)[4] in the summer of 1998 and then again in the spring of 2002. A one-fifth stratified sample of local governments in each state was identified in 1998, and the websites of those governments were coded to ascertain the extent that each website used components of the four areas of Web application (see the Information Gathering Sheets in the appendix to this chapter) identified above. The resulting sample of 145 local governments contained 114 (79 percent) municipalities and 31 (21 percent) counties. There were no statistically significant differences between cities and counties in the overall website score or the scores on any of the four application scales, so we combine the scores of the two forms of local government in the discussion below.

There were 30 separate indicators in the four areas of application in both the 1998 and 2002 surveys that we sought to code in the local government websites. While no local governments received perfect scores of 30 in 1998, two (Palmdale, CA and Roanoke, VA) received perfect scores in 2002. In 1998, the highest score of 23 was obtained by Roanoke, while scores of 22 were obtained by Virginia Beach; Annapolis; Torrance, CA; Cape Girardeau, MO; Des Moines, WA; and San Bernardino County, CA. Other high scores (29) in 2002 were in Volusia County, FL, Richardson, TX, and Virginia Beach. Low-scoring websites in 1998 were Riverton, WY (0); Stillwater, MN (1); Blackfoot, ID (3); and Wakefield, MA (3). In 2002, low-scoring websites included Embarrass, MN(4); and San Pedro, CA (7). Some five local governments who had websites in 1998 did not have websites in 2002[5] (Auglaize County, OH; Monroe Township, NJ; Hesston, KS; Blackfoot, ID; and Quincy, FL). The mean, maximum, and minimum scores for the overall website index and the four utilization scores for both the 1998 and 2002 surveys are included as Table 1.

In 1998, there were ten indicators of the bulletin board-type application; the highest score that any local government attained was 10. Highly ranked governments on the bulletin board utilization were Tumwater, WA (10); St. Charles County, MO (9); and seven municipalities tied at 8. There were 13 indicators of the promotion-type application; the highest score that any local government attained was 13. This was attained by five local government websites: Roanoke; Volusia County, FL; Simi Valley, CA; Anderson, IN; and

Table 1. Comparison of Website Features on Overall Scale and Four Sub-Scales (1998-2002)

	OVERALL		BULLETIN BOARD		PROMOTION		SERVICE DELIVERY		SOLICIT FEEDBACK	
	1998	2002	1998	2002	1998	2002	1998	2002	1998	2002
Mean	13.9	21.4	4.8	7.4	7.5	10.6	.5	2.2	1.1	1.2
Median	14	22	5	8	8	11	0	2	1	1
Maximum	23	30	10	10	13	13	3	6	3	3
Minimum	0	4	0	0	0	2	0	0	0	0
N	145	140	145	140	145	140	145	140	145	140

Aurora, NE. These five were followed by fourteen websites tied with scores of 12. By 2002, there were nineteen websites tied with perfect scores of 13 (Roanoke; Virginia Beach; Annapolis; Tuscaloosa; College Station, TX; Lufkin, TX; Catawba County, NC; Renton, WA; Winston-Salem, NC; Tompkins County, NY; Rocky Mount, NC; Oak Ridge, TN; Kitsap County, WA; Texas City, TX; Richardson, TX; Palmdale, CA; Maricopa County, AZ; Floyd County, VA; and Muskego, WI.) These were followed by some 48 websites with scores of 12.

In 1998, there were six indicators of the service delivery-type application; no government website attained a score higher than three on this scale. Roanoke; College Station; Renton, WA; and Norristown, PA, all attained that score. By our 2002 survey, there were eight websites with perfect scores of six: Roanoke, Palmdale, CA; Volusia County, FL; Cape Girardeau, MO; Thomasville, GA; San Jacinto, CA; Murietta, CA; and Honolulu County, HI. These were followed by seven local government websites with scores of five.

Last, there were three indicators of the feedback solicitation application. In 1998, San Bernardino County; Manhattan Beach, CA; and Roswell, NM, all scored at this highest level of feedback solicitation. By 2002, none of these three were still at this high level; two other websites—those of Birmingham, AL, and Hot Springs, AR, had replaced them. The websites of these two local governments were followed by some 30 others tied at a score of two.

More interesting than the absolute scores of the local governments on these four scales is the interrelationship of the scales themselves. In 1998, the scales were interrelated with low to moderate correlations. The bulletin board utilization was significantly correlated with all three other scales (Pearson's r = .31 with promotion; .36 with service delivery; and .25 with feedback solicitation), supporting the argument made above that bulletin board applications are the baseline of Web utilizations. Promotion was moderately correlated with service delivery (.25) and with feedback solicitation (.20). Feedback solicitation was insignificantly correlated with service delivery (.07) and so was *only* significantly correlated with the bulletin board application. The hypothesized structure in the four areas of Web page design is therefore somewhat supported by empirical observation—bulletin board uses appear to be both the most common and to be at the base of any hierarchy of uses that Web pages show. Above bulletin board uses would be promotion, then service delivery; feedback solicitation would be at the top of the hierarchy, being the least common and most specialized of any of the four uses.

The structure of the four utilizations in 2002 is somewhat different—all four utilizations are significantly related to each other. The bulletin board utilization was significantly correlated to all three other scales, as above (Pearson's r = .53 with promotion; .48 with service delivery; and .26 with feedback solicitation). Promotion is significantly related to service delivery (.50) and with feedback solicitation (.26). Although all of the correlations are statistically significant, they decline as one moves from the bulletin board utilization to feedback solicitation, thus displaying some evidence supporting the hypothesized hierarchical structure described above.

It should he noted, however, that there is little across time consistency in the individual scores for the four utilizations. So, the two bulletin board scores (1998 and 2002) are correlated only at the .25 level; the two promotion scores are correlated at the .24 level; the two service delivery scores at the .23 level (all statistically significant), while the two feedback solicitation scores are not related to each other at all (.00).

The pattern that emerges from all this data is one with a great deal of individual variation from 1998 to 2002 (low over-time correlations) with general improvement across all four scales (increase in mean scores) and somewhat more consistency across the four utilizations (higher intercorrelations)—those local governments having websites that have a great deal of bulletin board features also have websites with promotion features, service delivery features, and (to a lesser extent) feedback solicitation features.

It should also be apparent that these surveys show that local government websites are not nearly as sophisticated as they could be. In 1998, only some 4.1 percent (n = 6) of local government websites scored a zero on the bulletin board scale and only 1.4 percent (n = 2) scored a zero on the promotion scale. But 63.4 percent (n = 92) scored a zero on the service delivery utilization and 20.7 percent (n = 30) scored a zero on feedback solicitation. In 2002, a similar pattern held, with only 1 local government website scoring a zero on the bulletin board utilization and only 2 scoring zero on the promotion utilization, while 20 percent (n = 28) scored zero on the service delivery utilization and 4.3 percent (n = 6) scored zero on feedback solicitation. There are two conclusions to be drawn from this. First, the two more technologically sophisticated utilizations are also the ones that large numbers of local governments do not utilize at all. But second, local government websites are getting more sophisticated, and they are doing so at a fairly rapid rate. In four years, the number of websites that did not allow for any form of service delivery dropped from 92 (63 percent) to 28 (20 precent), and the number of websites that did not allow for any feedback solicitation dropped from 30 (21 percent) to 6 (4 percent). And this evolution comes at a time when security and economic issues have tended to dominate discussions of the use of the Web by government.

The surveys of the four utilizations show a great deal of increasing sophistication and evolution of local government websites. This is supported by several other observations drawn from the survey data concerning the management of websites. In order to address questions of site management, we coded several variables for each website. As data were collected on site management variables, the coders noted whether the website identified in 1998 was still accurate in 2002 or whether it had changed. Some 35 precent (n = 50) of the websites in our data set had changed in the four-year time period. Not only is this a high incidence of change, but the changes tended to be in certain directions, having to do with an increasing standardization of site management and administration.[6]

In 1998, many of the local government websites that went on to change in the next four years were products of a local network either established by the local government or to which the local government belonged. By 2002, these local governments had free-standing websites with more standardized Uniform Resource Identifiers (URIs).[7] Most of the local government websites that changed URIs in the four-year period adopted the country-naming standard that has emerged as a model in much of local government website management. Stark (2000) explains this naming convention:

> *Most local government websites follow the country-naming standard rather than the traditional domain naming system. This alternative standard provides the user with information on the server's geographic location, which is particularly relevant information for local governments. . . . The country-naming standard works as follows. The last segment of a domain name is the website's two-letter country code, such as "us" for the United States and "ca" for Canada. Working from right to left, the next code is the official two-letter state abbreviation, such as "mi" for Michigan and "co" for Colorado. Immediately to the left of the state abbreviation is the full name or abbreviation of the local government. The next code, still working from right to left, is a two-letter code identifying the type of local government: "ci" for city; "twp" for township; "co" for county; and, "vi" for village. . . . Using this system, the Internet address for the city of Salisbury, NC would be http://www.ci.salisbury.nc.us. Residents of Westchester County, NY should find their county's home page at http://www.co.westchester.ny.us. Individuals from around the globe similarly should have no trouble accessing the home page*

> *for the township of Grand Rapids, MI if its address is http://www.twp.grand-rapids.mi.us. An original address that does not follow this system such as http://www.rafting.org might be a very clever home page for Grand Rapids township, but it would be hard to find without a search engine. Officials of Orange County, FL slightly bent this rule, but with a purpose, as they selected http://www.citizens-first.co.orange.fl.us as their county's home page address (Stark, 2000).*

The administration of local government websites is the other issue that can be addressed through our survey data. In 1998, some 25% (37) of the 145 websites were administered by local government on its own. Some 32% (47) sites were administered by organizations outside of local government acting on their own. Most of these were local nonprofit organizations or businesses, but one city's website was maintained by a local university and another by the local Chamber of Commerce. Another 9% (13) of websites were administered by such organizations acting in conjunction with local government. By 2002, this pattern had changed completely—some 53% (78) of the websites were administered by local government, a finding that is in tune with the recent ICMA survey of e-government (Norris, Fletcher & Holden, 2001). The remaining 47% of websites were administered by either a local business or nonprofit organization (35%, n=52) or by a national or regional Web-hosting company (8%, n = 11). This latter form of administration—basically contracting with a firm for website administration functions—did not exist in our survey data in 1998 but has increased in popularity in the last four years.

Such popularity is potentially explainable both from the perspective of the popularity in local government of many forms of contracting and also from the perspective of the expense of maintaining a Web presence for smaller governments in a time of economic slowdown. Our 2002 data does show a marked difference in 2000 US Census population figures for the three forms of administration. Local governments who maintain their own websites show a mean population of 328,240. Those who use local organizations to maintain their websites show a mean population of 132,073, while those who contract with a national or regional Web-hosting company show a mean population of 42,266. While it may be less costly, both financially and administratively, to move paper documents onto the Web and to move from a physical permit application process to a virtual one, a Web presence still has real financial, administrative, and personnel costs. Devoting a full-time (or even a part-time) employee to building and maintaining a website may be too financially ambitious

Table 2. Selected Online Resources for Local Government Web Designers and Administrators

ORGANIZATION	URI
Center for Technology in Government	www.ctg.albany.edu
Government Technology	www.govtech.net
Institute for Electronic Government	www.leg.ibm.com
National Association of Counties	http://www.naco.org/programs/infotech
National League of Cities/National Association of Counties*	http://www.totalwebgov.com
Public Technology, Inc.	http://pti.nw.dc.us
World Order of Webmasters	http://joinwow.org/gov
WWW Consortium	www.w3.org

** Fee charged for subscription.*

for smaller governments to do, and so the option of contracting this function out to a professional service appears attractive to at least some of these small local governments.

DESIGNING AND MANAGING A WEBSITE

In recent years, a number of guides for local government managers who want to establish a Web presence have been published (Stark, 2000; Center for Technology in Government, 2001). In addition, a great deal of technical assistance is available on the Web itself for local governments who want to improve their websites. Some of these are included in Table 2. Since these guides and websites do an excellent job of addressing Web design issues, and since some 83% of local governments in the recent ICMA survey reported already having a working website (Norris, Fletcher & Holden, 2001), our discussion here will be devoted to Web management issues.

Planning. Past research on computer application in public and private organizations has demonstrated that simply focusing on the technical aspect of a new technology will not achieve the results as expected (Davenport, 1993; Hammer & Champy, 1993; Overman & Loraine, 1994; Cats-Baril & Thompson, 1995). Any gains from investment in computer technology depend on: (1) management decisions that shape the path of technology diffusion; (2) resources that are available; (3) government employees who use computers; (4) the population that is served by the organization; and (5) past computer use in the organization (Caudle, 1990; King & Kraemer, 1988; Martin & Overman, 1988; Northrop, Kraemer, Dunkle, & King, 1990; Brudney & Selden, 1995).

In deciding what information to place on the Web, we have delineated two common rules. First, all the information that can be made public and be considered of importance to the public can be put online. This includes information on the agency's services, programs, policies or regulations, the names, telephone numbers, and e-mail addresses of its key personnel, job opportunities, important events associated with the organization, etc. A website can also link to other websites that provide information about the local community such as school, hospital, news media, recreation, business, demographics, environment, etc. Second, all the services that only involve paperwork can be delivered through the Web. An example will be an application for a home business license. To accomplish this in person, the process will start with a visit by an applicant to city hall to obtain all the application forms and instructions from city clerks or the department granting the license. But such a trip can be saved if the forms and instructions are put on a Web server for anyone to download.

The choice of exactly what information to place online is, of course, a much more complicated matter than stated here. Only a large group of decision makers can develop a comprehensive list of such information; leaving the decision to one person (or a small group of people) risks omitting key pieces of information in which the public may be interested. Most importantly, however, it is not necessary to decide once-and-for-all what information to put online–websites can be designed to solicit feedback for users as to what information they would like to see on the website that is currently not provided. As our 1998 and 2002 surveys showed, however, very few local government websites solicit such feedback.

A second issue concerning information placed on a website has to do with security. In the past, the rule was (as noted above), the more the better. However, in our recent security-conscious environment, governmental agencies are rethinking what information should be placed online or made freely available to the public. Gellman (2002) reports that information gleaned from websites in Silicon Valley was found on Al Qaeda computers in Afghanistan after US troops seized those computers. National Public Radio reporter Allison Aubrey reported on *All Things Considered* that the US Environmental Protection Agency removed information about the dangers of accidents at chemical plants around the US, because such information might supply terrorists with knowledge about where potentially dangerous chemicals are stored and how secure storage of the chemicals actually is (Government Off the Web, 2001). And NPR's Adam Hochberg has reported that states are reconsidering portions of their public records laws that mandate public access to certain government documents (and also determine what information can be placed on websites) in light of terrorist incidents and the possibility that terrorists are getting potentially damaging information on such subjects as water supplies, nuclear power plants, etc. (Terrorists & Libraries, 2002) from state and local websites.[8] Or, as Steve Aftergood of the Federation of American Scientists' Project on Government Secrecy put it, "I have had to come to terms with the fact that government secrecy is not the worst thing in the world. . . . There are worse things" (Toner, 2001, B4).

Much more than simple posting of information can be done with the Web if a government agency has the necessary technical expertise and its Web server is equipped with interactive capability. Again, take the application for a home business license, for example. Typically, after getting the application forms and instructions, an applicant must fill the forms and mail them to the licensing agency. But in at least forty of the 145 of the cities and counties in our 2002 survey, not only is there no need to visit city hall or the county courthouse for the forms or instructions, an applicant need not send the forms back via the mail at all. He or she can supply all the information on the government's Web server and send it to the relevant office by simply clicking a "submit" button. Residents that have this type of interactive website might also be able to request other services as well via the Web—they can complain about shady businesses, airport noise, traffic conditions, discrimination, or the state of the city in general; they can request graffiti removal, street maintenance, bus itineraries, or library cards; and they can also report petty thefts, sign up for recreation classes, register for volunteer activities, and pay some taxes or fees.

A common error in many Web applications is the overemphasis on formats. The Web is attractive in a large part as a result of its multimedia interface, which has offered a variety of means for data presentation and service delivery. A creative use of multimedia enhances the functionality of Web pages and reduces the boredom. It brings attention to important information conveyed via the Web. However, overuse of multimedia can be counterproductive. A Web page garnished with elegant graphics or animated pictures, for instance, often takes a long time to be loaded on a user's computer (unless the user happens to have a high-speed Internet connection), forcing the user to stare at his or her computer monitor waiting for something to happen. In the case of audio and video, not only does transferring files take a long time, but additional software is often required for the program to display its full effect. Designers must be aware that long waiting time and frequent technical troubles can easily turn away the browsing public. The city of Greenville, NC's website in the mid-1990s included audio greetings from the mayor. The greeting message included a short description of the city, its geographical location in North Carolina, the fact that it was the home of East Carolina University, etc. While this greeting was an attractive feature of the website, it was discontinued (and the website simplified) after users complained about the amount of time the message took to download.

There is no universal rule as to what and how much multimedia should be used in a particular case. The rule of thumb is that if a format does not serve any functional purpose, then it should not be used. A government website is not for entertainment purposes. Another point to bear in mind is that a functional website should have a clean and short front page that provides a general overview of the information available on the website. The requirement of being short also applies to other components of a website. A Web page that forces a viewer to scroll down and up or left and right many times will turn away many people. Extensive text also requires users to read in a way that they are not accustomed to doing on a computer. Research has shown that users read websites similar to how they read newspapers, scanning headlines and perhaps reading a few of the beginning sentences in an article before moving to other headlines and articles (Morkes & Nielsen, 1997). Thus providing long text articles on a website makes it unlikely that the user will read the entire article. A CGI or Java program that takes a long time to execute can also be frustrating. The solution is to break a long document or program into small and sequentially related segments and to use hyperlinks to allow the user to jump to other parts of the website (or other websites) when he or she wishes.

Hyperlinks embedded in website text can take the user to a variety of related sites. Often, Web designers will highlight uncommon or jargon words in a document and link these to definitions so that the naive or inexperienced user can jump to the definition, read how the website is using the word, and then jump back to the document to continue browsing. The hyperlink need not be textual—Web designers can use PowerPoint slides to illustrate points they are attempting to make, or insert audio explanations, or short streaming video to address issues that are better explained visually rather than textually. However, while all of this is technically possible, the Web designer needs to remember that each time a high bandwidth application is included in a website, it will slow down the access of users who have relatively slow connections. While many users today are linked to the Internet via fast cable modems or DSL lines, many still rely on slower dial-up services with 56K or even 28K modems. Attempting to access streaming video, for example, from a 56K modem dial-up service is virtually an exercise in frustration, one that Web designers (most of whom abandoned their dial-up services years ago) might not readily appreciate. As Stark (2001) puts it, "Portions of the local government site geared to residential users should definitely be keyed to minimal technical capacity. It may be wise to also offer a text-only version for users with slow connections or individuals who prefer textual presentations, including many senior citizens. Sections intended primarily for business users, however, could be developed with an assumption of higher technical capability." The point is that the local government Web designer needs to know the potential market for each of the features incorporated in the website, and the only way for the designer to know this is to consult broadly with those both inside and outside of local government (see the discussion below on personnel).

Funding. While the initial investment for a website is manageable for most government agencies, the cost of maintenance could be a serious problem. Maintenance of websites can become a costly item for local governments. Running a website requires a level of technical expertise often beyond what most local governments are accustomed to and their employees are ready for. The cost of hiring computer specialists can be prohibitive for some local governments, even in a slack job market.[9] According to the research on technological adoption in the public sector, government units of small size or located in the less-developed areas tend to lag behind large governments in keeping with technological innovation, because they are either constrained by their limited resources or by the small returns from investment in technology (Walker, 1969; Agnew, Brown & Herr, 1978; Smith & Taebel, 1985; Brudney & Selden, 1995).

From our 1998 and 2002 surveys, we have found several possible solutions to this problem. The first is to solicit donations from the private sector in exchange for advertisement space on an agency's Web pages. The city government of Greenville, North Carolina, exemplifies this approach as its website is financially sponsored in part by Pepsi Cola, Inc. The second solution is a kind of cost-sharing arrangement among several government units. In the San Francisco Bay area of California, local governments share the cost of one website where each contributor has the access to its share of space. Milward and Snyder (1996) have made a convincing case for cost sharing from service perspective. They argue that a cooperative arrangement will help integrate clients with the services they need. A homeless mentally ill person, for example, will need food and shelter from the social service department and a medical evaluation and care from the mental health unit. While Milward and Snyder's interest is mainly in computer networking, the argument they make offers a useful insight into the funding problem of Web application.

A third possible solution is to attempt to reduce costs through outsourcing Web development and maintenance. As indicated above, relatively few local governments use this form of potential cost reduction (8 percent), but there is little empirical evidence that contracting for Web-related services actually reduces costs in comparison to own-source provision of such services. Outsourced provision may make Web services possible for local governments that do not have such capacity to develop such services on their own (and may do so in a cost-effective manner), but there is little if any research that directly compares outsourced services with own-source services.

Personnel. The third aspect of Web application concerns government personnel who use the technology. A successful Web presence must involve employees in every functional department of a government from the very beginning, especially those who have direct contacts with the public. This is because these employees know more about what information and services ought to be posted online than do computer technicians. Another benefit of increasing employee participation is to boost the level of responsiveness to citizens requesting information and services. There is evidence that in public organizations employees in functional departments are more interested in new technologies than computer specialists and top managers (Bugler & Bretschneider, 1993; Caudle, 1990). According to Kraemer and Dedrick (1997), this is because program and middle-level managers are more likely to be engaged with people outside the organizations and understand the problems and challenges facing the organizations. Users also need to be consulted about a website's performance, and this consultation needs to be conducted on an ongoing basis. Given this, it is reassuring that some 95% of the websites we surveyed in 2002 have provisions for user feedback incorporated into the website.[10]

Nevertheless, in the case of a Web presence, a centralized coordination must be maintained as to who has access to a website (access here means that a person can alter the contents of a Web page, enter, and delete Web pages) and how the Web pages are connected. While much of the centralization-decentralization debate in computer technology has centered on questions of economies of scale (Danziger et al., 1993; Reschenthaler & Thompson, 1996), we find such questions to be virtually moot in this case. The technology of computer design has changed enough that a decentralized computing environment can now show the same kinds of economies that a centralized, main-frame system showed in the past. Thus we support a balanced control model of computer management. This is based on the recognition that a government agency must present a unified image to the browsing public and that the data on a Web server need to be updated, integrated, and safe-guarded. What is more, managing a website involves some difficult technical problems that require a certain degree of technical expertise. In general, designing and writing a simple Web page is a relatively easy task. Anyone who can do word processing on computer can master the vocabulary and grammar of HTML language with some basic training. Both Netscape and Microsoft have incorporated the element in their latest versions of their Web browsers, enabling a user to compose a Web page directly, while some newer versions of popular word processing programs such as WordPerfect and Word have the ability to design Web pages directly. But a simple HTML document can create only a static Web page. When the application moves towards a higher level—involving database searches, interactive citizen input, and service delivery—Web pages must be integrated with some database, CGI programs and Java applets. Such integration, along with security and other networking needs, would require a certain degree of technical expertise in database management, programming, and network engineering.

From the management point of view, a balanced model is more difficult to manage than a purely decentralized or purely centralized model. A major problem is how to cultivate a cooperative relationship between network specialists and other employees when a website is run in-house. A number of surveys have found that computer technicians in the public sector tend to attribute problems in computer application to employees who they believe lack a good understanding of the role of information technology (Caudle & Gorr, 1991; Swain, White, & Hubbert, 1995). Conversely (but not surprisingly), nontechnical employees tend to put the blame squarely on computer technicians (Danziger et al., 1993). Successful communication and the solution of problems thus requires strong leadership from individuals who can move back and forth from the information technology to the nontechnical environments.

Outreach. Finally, we want to address the access problem. Current estimates of the number of users on the Web range upward of 90 million in the US alone and some 170 million worldwide, up from only 3 million in 1994. While the rate of expansion of Web users simply must slow down (as we approach virtually 100 percent saturation), the number would seem to certainly keep growing in the years to come. This suggests that online government services would have great potential in meeting public demand. But how can a government agency inform those customers who are equipped with Web access of the services provided online? There are two approaches to this. One approach, targeted mainly at local residents, is to utilize all the local media, such as newspaper, radio, and television, to bring about some publicity for a government website. Internet service providers in the local community can also provide information about local Web access. Government website addresses can be posted in telephone books, on mass transportation vehicles and facilities, on utility bills, etc. The other approach, targeted at the general online public, is to have a government website catalogued by such online search engines as Yahoo, Excite, or the meta-search engines such as Metacrawler, Google, or Teoma.

A more important question for a public agency is how to reach those customers who have no online access. The data on Internet use show that Web access is not randomly distributed, but rather correlated with socioeconomic and demographic differences—something that has been termed "the digital divide." Those who have lagged behind in catching the new technology tend to be minorities and have a low level of socioeconomic status (Novak & Hoffman, 1998). The implication of this is both ethical and technical. On the ethical side, with the different levels of the Web, online government services would benefit the affluent more than the poor, thus reinforcing the socioeconomic divide in the information era between the haves and the have-nots. On the technical side, the cost-benefit ratio in setting up and maintaining a government website may vary from one community to another. If the residents of a community have little Web access, the benefits may not justify the cost, unless local government is willing (as many have been) to devote resources to increasing Web access by lower income and minority populations. For example, programs to make free computer access available in public libraries have become quite popular. Several foundations, including the Bill and Melinda Gates Foundation, have been providing funding for such projects.

CONCLUSION

The Web represents a widely used technology for local government. The potential for the Web to reduce the costs of service delivery, promote civic pride, increase awareness of the types of programs local governments offer, etc., cannot be doubted by even the most casual observers of Internet operations. However, this potential is not being completely realized by current local government use of the Web. The surveys summarized in this chapter show that while there have been significant increases in the sophistication of local government websites, for a number of local governments, the Web is no more than an elaborated telephone directory—allowing those who access the Web page to see an online listing of city officials, along with titles, addresses (perhaps e-mail addresses), and telephone numbers. Fewer local governments have taken the additional steps to take fuller advantage of Web technology and move into e-government, by making their Web pages interactive, for example.

Our observations on the findings from our two surveys and our review of the literature on both Web adoption and technology diffusion are that this situation will continue as long as those in charge of Web technology at the local government level persist in thinking of the Web in the same terms as they think of more traditional avenues of service delivery, citizen input, and local promotion. When the Web was first introduced, several observers noted that it had the potential to remake virtually every type of human interaction. Web technology has been cited as a major component of the possible reforming of local government in several recent studies (Musso, Weare, & Hale, 2000). Several years of experience with the Web, coupled with the recent downturn in the economy and terrorist attacks of 2001, have caused some rethinking of this position. Many users of the Web who may refuse to be seduced by the promises of entirely new modes of interpersonal and intergovernmental exchanges may instead not recognize that the Web *can* fundamentally change *some* of the ways people interact with each other and with government. While the exaggerated claims of developers and pundits on the introduction of virtually any new technology should be treated with caution, one should also not underestimate the change that new technology can cause in an existing system. Local governments have been tempted to fit Web technology into their preexisting notion of what the relationship between itself and the population is and thus may be squandering the more innovative or progressive aspects of the Web. When local governments act in this way, they demonstrate the underlying business assumptions that much of the e-government movement is based on (Abramson & Means, 2001). All of this can result in underuse of the more sophisticated capabilities of the Web. As more and more people become accustomed to going online to conduct such things as their personal correspondence, banking, travel plans, etc., local government cannot afford to be left behind. But the process is not a simple or quick one. Musso et al. (2000) perhaps best sum up this qualified conclusion when they write:

> *Although a handful of exemplary municipal websites in California support a rich mix of Internet services furthering multiple reform goals, the vast majority of sites do not appear to be designed to support any of our municipal reform models. Most focus on superficial information and communication capabilities that merely mimic existing communication systems . . . . Few offer more detailed content that might enrich citizens' access to their governments . . . . To the extent that these sites do support reform, most are primarily oriented toward entrepreneurial reforms and, hence, are more likely to support "good management" than "good democracy" (Musso et al., 2000, 16).*

While local governments have come a long way in their use of the Web to further both good management and good democracy, they have a long way yet to go.

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ENDNOTES

[1] I wish to thank Yuhang Shi for his co-authorship of the original version of this chapter. The current version represents a thorough update and rewriting of that version.

[2] The potential of a Web server can be enhanced significantly in at least two ways. The first is to connect a Web page to an external application following a standard known as Common Gateway Interface (CGI). Let's say that we want to set up a Web server to let people from all over the world find some specific information about our community. Since the database is so large we cannot put everything in a few Web pages. To overcome this problem, we can create a CGI program and put it on the Web server along with the database. Once a viewer connects to the Web server and decides the item he or she needs, the server will execute the CGI program to search the database for the information requested. Once the search is completed, the server sends the results back to the viewer. A CGI program is executed in real-time, so that it can output dynamic information. Since a process like this can be repeated as many times as it is needed, we can make Web browsing a two-way street and solicit input from a viewer. The second approach to increasing the capacity of a Web server is to include Java applets in Web pages. A Java applet comprises a series of Java codes intended to accomplish a particular task and executed on a viewer's computer. It works like this: Suppose that we want to let citizens know the property tax they have to pay for the motor vehicles they own. Since the tax schedule varies from one type of vehicle to another, it will cause confusion if we put all the tax codes on a Web page. What we can do is write a Java applet that can calculate a viewer's tax liability based on the information supplied by the viewer, and attach that applet to a Web page. When the viewer connects to the Web page, the applet will be sent to his computer and then executed by the Web browser on his computer. After the viewer supplies necessary information about the make, model, and year of the motor vehicle he or she owns, the program will calculate the tax and the result of the calculation will then be displayed. While such an application

requires a viewer to have a recent version of Netscape or Microsoft Web browser, it has several advantages. First, since Java codes are not specific to a particular operating system, we don't need to worry what kind of computer a viewer uses. Second, like a CGI program, a Java applet can increase the interaction between a Web server and a viewer. It allows us to collect input from a viewer in the form of mouse clicks, keystrokes and the like. Third, because a Java applet is run on a viewer's computer, it can save time, especially when a website has a large amount of hits.

[3] For example, the issue of alleged racial discrimination by police officers in arrests might be of interest to a larger community than simply the residents of a given city as the recent case of policy brutality in Cincinnati demonstrates.

[4] PTI, Inc. is "the non-profit technology research, development and commercialization organization for all cities and counties in the United States. The National League of Cities (NLC), the National Association of Counties (NACo), and the International City/County Management Association (ICMA) provide PTI with its policy direction, while a select group of city and county members conduct applied R&D and technology transfer functions" (www.pti.nw.dc.us). PTI also maintains an excellent review of e-government service delivery related links, research articles, PowerPoint slide shows, etc. at their website: http://pti.nw.dc.us/links/e_government.html.

[5] An exhaustive search for these websites revealed that the local government's official website had been discontinued. For several of the five, there were Chamber of Commerce, state sponsored, private, or organizational (weather underground, etc.) websites that included some of the information queried by the surveys. But none of these websites were the official site of the local government where there had once been one.

[6] In addition, there were 5 local governments who had a Web presence in 1998 but did not in 2002. These were not counted as changed websites. Four of these five lapsed websites were parts of local or regional networks while the fifth had a university Web address.

[7] In the late 1990s, the acronym URI formally replaced the older URL (Uniform Resource Locator) as the formal descriptor of a site's Web address. See Naming and Addressing: URIs, URLs . . . (1997).

[8] Also see Kriz (2001) and Toner (2001).

[9] The 2000 ICMA survey indicates a mean salary of $42,527 reported for the 154 municipalities from which this data were gathered.

[10] This is up from 79% in 1998.

APPENDIX

Information Gathering Sheets

0. General

1. Date of Recording ____
2. Name of City or County ___________________________________
3. Website URL ____
4. Who administers the website?
   a. Government agency __________
   b. Chamber of Commerce ______
   c. University or College _________
   d. Single Sponsor ______________
   e. Joint Sponsor _______________
5. Date of the last update in the website ____________

I. Bulletin Board

1. Does the website contain an organization chart for the agency?
   Yes ____
   No _____
   Note ___________________________________
2. Does the website contain the information about the services the agency provides?
   Yes _____
   No _____
   Note ___________________________________
3. Does the website profile the key government officials?
   a. Name: Yes _____ No ______
   b. Telephone number: Yes ______ No ______
   c. Mailing addresses: Yes ______ No ______
   d. Others __________________________________
   Note: ____________________________________
4. Does the website contain the information about job opportunity with the agency?
   Yes ______
   No ______
   Note ____________________________________
5. Does the website contain the information on important events?
   a. Council meeting: Yes ______ No ________
   b. Public hearing: Yes ______ No ________
   c. Voting/elections: Yes ______ No ________

d. Budgets: Yes ______ No ________
e. Others: ________________________________
Note: _________________________________

II. Promotion

1. Does the website contain or provide the links to the information about the area?

a. Population	Yes _____	No _____
b. Economy	Yes _____	No _____
c. Business opportunity	Yes _____	No _____
d. Transportation	Yes _____	No _____
e. Recreation facilities	Yes _____	No _____
f. Public health care	Yes _____	No _____
g. Schools	Yes _____	No _____
h. Libraries	Yes _____	No _____
i. Community	Yes _____	No _____
j. Entertainment	Yes _____	No _____
k. Tourist facilities	Yes _____	No _____

l. Others ____________________________________
Note: ______________________________________

2. Does the website have connection to other institutions serving the public?

Yes ______
No ______
If yes, what are those institutions?
____
Note ____

3. Does the website use Geographic Information System to provide any spatial or demographic information?

Yes _______
No ________
Note ____

III. Service delivery

1. Does the website contain the information on local taxes, fees, etc.?

Yes _____
No _____
Note ____________________________

2. Does the website allow a user to pay local taxes, fees or other charges?

Yes ______

No ______
Note ________________________________

3. Does the website allow a resident to place an order for services?
Yes ______
No ______
If yes, what are those services?
____
Note _________________________________

4. Does the website contain the information on government procurement?
Yes _____
No ______
Note _________________________________

5. Does the website contain the information on government contract?
Yes _____
No _____
Note _________________________________

6. Does the website allow a resident to apply for licenses and permits?
Yes _____
No _____
Note _________________________________

IV. Feedback solicitation

1. Does the website invite any feedback?
Yes _____
No _____
Note _________________________________

2. Does the website ask a user to supply any information about him- or herself?
Yes _____
No _____
Note _________________________________

3. Does the website contain or provide a link to some kind of discussion groups?
Yes _____
No _____
Note ________________________________

GLOSSARY

Bulletin Board: A way of utilizing the Web to publish on-line information regarding the services government provides, the programs it runs, the policies or regulations it enforces, the names, telephone numbers and e-mail addresses of its personnel, and other vital information.

Cable Modem: One of several new high-speed Internet connections. This allows users to connect to the Internet via their television cables and provides access (upload and download) speeds much higher than a typical dial-up connection.

Citizen Input (Feedback Solicitation): A way of utilizing the Web to allow citizens to communicate their concerns about local government directly to governmental personnel. This information is used as feedback to redesign local government programs to better service clientele.

Common Gateway Interface (CGI): A standard computer interface for connecting a single computer to an external application on the Web.

Country-Naming Standard: One of the two standards developed to name a Web address. The country naming standard ends the Web address with a two letter abbreviation of the country in which the address is located. Each of the elements of the address provides a geographical location for the address.

Cyberspace: Reality as it exists inside a computer network.

Digital Divide: The notion that use of the Internet and other high technologies is divided between relatively affluent users who have excellent access and lower-income, minority users who have much poorer access.

Digital Subscriber Line (DSL): One of several new high-speed Internet connections. DSL allows users to connect to the Internet via normal copper telephone wires and provides access (upload and download) speeds much higher than a typical dial-up connection.

Domain Name System (DNS): One of the two standards developed to name a Web address. The domain name system is hierarchically structured and allows a ‘handle’ to be assigned to a computer within a network such that other computers can send and receive information to it.

E-Government: The use of information technology by government. The term carries with it a connotation of the transformation of the traditional relationship between citizen and government into one that can make service delivery and citizen participation in government more effective.

Geographical Information System (GIS): Computer software and hardware that combines mapping applications with the ability to overlay the maps generated with data drawn from a variety of sources (US Census, survey data, etc.).

Hyperlink: An element in an electronic document that links to another place in the same document or to a completely different document.

Hypertext Markup Language (HTML): A plain text set of instructions for formatting (tags) a set of data for a web page.

Java applet: A computer program (developed by Sun Computers, Inc.) intended to accomplish a specific task which is downloaded automatically to a user's computer when he or she accesses a Web page.

Promotion: A way of utilizing the Web to offer a wide range of information about the local area in which a government is located. Such information can include data on the population, economy, education, recreation, etc. in the community. The purpose of this type of application is to raise the profile of an area, increase community spirit, and attract outsiders.

Service Delivery: A way of utilizing the Web to provide governmental services to citizens online. An example is the ability to pay local property taxes through a city or county website.

Total Quality Management (TQM): A management philosophy, developed by W. Edwards Deming, which, when applied to government, emphasizes the entrepreneurial nature of government programs.

Uniform Resource Identifier (URI): The way a resource (Web page address, video clip, program, etc.) is identified on the Internet.

World Wide Web (Web): A network of computers joined together by hyperlinks which emphasizes the graphical display of data.

Chapter XIV

Toward an Information Technology Research Agenda for Public Administration

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ABSTRACT

Research questions are outlined, forming the dimensions of a research agenda for the study of information technology (IT) in public administration. The dimensions selected as being the most theoretically important include the issue of the impact of information technology on the distribution of power; the issue of information resource equity and the "digital divide"; the issue of the use of IT as symbolic action; the issue of the impact of IT on discretion; the issue of the impact of IT on organizational culture; the issue of privatization; the issue of decentralization; the issue of remote work; the issue of implementation success factors; the issue of persuasiveness of governmental websites; the issue of regulation of social vices mediated by IT; and other regulatory issues.

INTRODUCTION

If anything has mushroomed faster in the past quarter century than information technology, it is perhaps literature *about* information technology. One large chunk of this literature is theoretically descriptive of various IT projects, another large segment is on the order of "how-to" manuals, and yet more centers on policy guidelines about computer security, privacy, access, and other management concerns. When one seeks "theoretical" literature on information technology one is apt to find empirically-disconnected speculation infused with utopian optimism or dystopian cynicism. There remains, however, a growing body of work which is empirically grounded yet raises issues of broad theoretical import to the public administration community. In this essay an attempt has been made to identify some of the primary dimensions of this body of work and to outline the research agenda which it poses.

POLITICAL ISSUES

The Issue of Impact on Power Distribution

Enthusiasts for the Information Age have seen technology as an irresistible force for democratization of institutions and societies. It is an open empirical research question, however, whether the rise of public information technology and e-government does, in fact, increase participation levels or even affect the distribution of power. A number of public administrationists, such as the authors associated with Heeks (1999), argue that properly implemented information technology will "reinvent government" by decentralizing bureaucracy and empowering communities and citizens. This is in line with a number of authors who have argued that the Internet empowers individuals and communities by providing a new, democratic forum for both civic debate and civic action, thereby increasing social capital, as is, for example, the hope of the "smart communities" movement in Canada (Coe, Paquet, & Roy, 1999) and the "digital places" movement in the United States (Horan, 2000). Many authors over a long period of time have articulated this optimistic view of information technology and democratization (e.g., Sackman & Nie, eds., 1970; Hiltz & Turoff, 1978; Becker & Scarce, 1984; Rheingold, 1994; Jones, 1995; Negroponte, 1995; Mantovani, 1996; Schneider, 1996; Schiller, 1996; Cohill & Kavanaugh, 1997; Alexander & Grubbs, 1998; Warren & Wechsler, 1999; Blanchard & Horan, 2000).

Protestors from Chinese dissidents at Tiananmen Square to World Trade Organization demonstrators to terrorists of Ben Laden's Al Qaeda network have used the Internet extensively, as have a host of environmental, welfare, and assorted other activist groups. Advocates for women have routinely extolled the Internet for its capacity to empower women (Harcourt, 1999). The labor movement has made extensive use of the Internet (Lee, 1997). The Internet makes possible a wide range of activist tactics, from mass e-mail letter-writing campaigns to cyber-terrorist damage to the computer networks of enemies. Numerous studies emphasize the capacity of the Internet in particular to promote political organizing and mobilization, even when organizers have few resources by traditional standards (Bonchek, 1995; Grossman, 1995; Wittig & Schmitz, 1996; Gurak, 1997; Bimber, 1998; Tsagarousianou, Tambini, & Bryan, 1998). Postmes and Brunsting (2002) attribute the global rise in activism in part to resources provided by the Internet. More generally, it appears that citizens are taking a more active role and demanding more information, knowing that IT makes "open government" more possible (King, Feltry, & O'Neil, 1998).

Nonetheless, thus far the bulk of scholarly opinion is on the side of viewing IT primarily as a tool like any other tool, conferring power on the wielder of the tool. And as the wielder with the greatest resources to exploit computers and the Internet tends to be a member of the powers that be, IT functions primarily as a tool to consolidate the status quo, of little overall political consequence and certainly not a harbinger of revolution. Gattiker (2001) notes, for example, that the Internet does offer additional avenues for political participation but mostly functions simply as one more communications medium, in addition to print, radio, and television, equally prone to manipulation by lobbyists and well-funded interests with the resources and motives to invest in the medium. Other researchers who have found that IT implementation does not disrupt the persistence of existing political structures within organizations include Danziger, Dutten, Kling, and Kraemer (1982), Kraemer (1991), Kolleck (1993), Pinsonneault and Kraemer (1993), Robertson and Seneviratne (1995), and Riedel et al. (2000). Moreover, it should be noted that studies of other technologies, such as the telephone, have likewise found a lack of substantial impact of these technologies on the distribution of power (Fischer, 1992).

That IT either reinforces the status quo and increases political inequities, or at least does not challenge the status quo, is the theme of the dozen authors contributing to *Access Denied* (Lax, 2001). Likewise, critical social theorists such as Robins and Webster (1999) argue that the "information revolution" is not revolutionary at all but is simply an extension of capitalism, governed by the same profit-based rules. This point is reinforced by empirical studies (cf. Riedel et al., 2000) which find that market forces left to their own tend toward information inequality and undermine attempts to use the Internet for purposes of democratization.

In an empirical study of some 40 community-based information networks, Tonn, Sambrano, and Moore (2001, 201) concluded bluntly, "It does not appear that, either individually or in combination, the websites are working to strengthen the social capital of the communities they serve." In fact, information technology may be working in the opposite direction in American democracy. Novotny's (2000, 65) study of presidential election campaigns and IT noted, for instance, that technology was furthering political disengagement of the citizen: "Where candidates once coveted relationships with voters in their districts, they now purchase lists of these same voters on CD-ROM and data files on the World Wide Web as a part of the new campaign technologies."

The Research Need. The research need in relation to information technology and power distribution is to understand better the extent to which the Internet and information technology represent an additional tool of manipulation from the top, or as other authors (e.g., World Bank, 1999; Pruijt, 2001) argue, an empowering vehicle for the increase of social capital at the bottom. Although the preponderance of research to date on information technology and democratization tends to cast strong doubt on the enthusiasm of cyber-democracy advocates, it is nonetheless true that some efforts at using IT to extend democratic values are more successful than others, and this variance merits empirical explanation. Research is needed on the prerequisites and success factors associated with greater success (for a review of relevant studies, see Rocheleau, 1999), whether or not the overall picture is that IT reinforces the status quo. More broadly, research is needed to uncover how the Internet and related information technologies affect how issues are framed in public discourse, and whether there is an effect on national agenda-setting different from mass media in general.

The Issue of Impact on Resource Equity

One of the most-discussed topics in information technology literature has to do with assessing the import of the "digital divide"—the gap separating largely high socioeconomic status (SES) technology "haves" from largely low SES technology "have-nots" (Schiller, 1996). The digital divide separates the well-off from the poor, whites from blacks, technology corridors from "old economy" regions, rich nations from developing nations. To the extent that the digital divide exists, it is becoming critical for public administration because the rise of e-government means information technology inequality is directly related to unequal access to governmental services, not just unequal access to recreational cyber-media.

In its 1999 report, "Falling Through The Net: Defining the Digital Divide" (NTIA 1999), the US Commerce Department studied the extent of the digital divide for the United States for the 1988-1996 period.. This study document found significantly lower computer ownership and Internet access among Hispanics, blacks, rural individuals, central city residents, and those with low income. As one might expect, income was strongly related to computer ownership. A subsequent Commerce Department report (NTIA, 2000a) found minorities and rural residents were closing the digital divide. A third report (NTIA, 2000b) found that the digital divide had disappeared with respect to location (discounting lack of high-speed access in rural areas) and with respect to gender. Minorities, while closing the gap in computer ownership and Internet access since 1996, still lagged behind by about 20 percent, with lower income the primary cause. The digital divide for minorities is much narrower when education and income are controlled. A UCLA Center For Communication Policy study found Internet access was well on the way to becoming universal: 72.3 percent of Americans went online in 2001, up from 66.9 percent in 2000 (Lyman, 2001). Other recent studies have concurred that in the United States, the digital divide has sharply diminished or disappeared (Murdock, 2000; Thierer, 2000).

Within the United States there are several developments mitigating the digital divide. By the mid-1990s, inner city and rural public libraries and schools routinely had computers and Internet connections for public access (Henderson & King, 1995). There have been a large number of small-scale experiments, such as the community computing movement, which have sought with varying degrees of success to bring technological knowledge and even equipment into the hands of inner-city residents, minorities, and the technologically dispossessed (for examples, see Schuler, 1996; Schön, Sanyal, & Mitchell, 1999; O'Dubhchair et al., 2000; Shi & Scavo, 2000; Tonn, Zambrano, & Moore, 2001).

When one considers the digital divide between developed nations and poorer nations, the picture is less benign. A 1999 United Nations report concluded, for instance, that "new information and communications technologies are driving globalization—but polarizing the world into the connected and the isolated" (UNDP, 1999, 5). Hedley (2000, 278) found the "information revolution" was "limited primarily to the developed nations of the North." Ferguson (2000) has argued that absent an effective international communication policy (a less than likely prospect), the world may well divide into the information rich and the information poor. Prospects for Africa, in particular, seem pessimistic (Pfister, 2000). In general, nations which are underdeveloped in mass media will also be disadvantaged when it comes to introducing IT connectivity (Northrop, 2000). Even in the international field, however, there are initiatives which seek to remedy the situation, including the Sustainable Development Networking Program, established by the United Nations in 1991, with a mission to improve the connectivity of developing nations, and others discussed Funk (2000).

The Research Need. The issue of information technology's impact on resource equity raises two sets of research questions: (1) continued tracking, for the United States and internationally, of the actual extent of the digital divide and whether trends are toward convergence or divergence; and (2) prescriptively, what strategies would be required to successfully diminish the digital divide? Which ameliorative strategies are more successful than others, and why? While these questions may be defined narrowly in limited terms of hardware ownership and Internet connectivity, research is more meaningful when defined in systemic terms involving all those human as well as physical prerequisites to allowing an individual to be an effective user of information technology.

The Issue of IT as Symbolic Action

Because of the scientific mystique of information technology, IT can be used for purposes of symbolic action. That is, political ends may be pursued by wrapping the rationale for policy decisions in a cloak of technology, not because technology necessarily informs the decision better but because it mystifies and legitimates a line of policy preference. A general exposition of the symbolic uses of computer simulations and other IT-based analyses, noting their fallibility and subjectivity, is found in Saunders-Newton and Scott (1999). A specific example is given by Henman (2001), who traces how computer simulation was used as symbolic action to promote a particular version on natural gas policy.

At the same time, it is generally acknowledged that many, many forms of computer simulation and IT-based computational analysis are helpful and at times critical to arriving at appropriate decisions. Endless examples could be cited, including tax and welfare policy simulations (Burley, 1999; Rohrbaugh, 2000). For a survey, see Anagnoson (2000).

The Research Need. The research need regarding symbolic uses of information technology engender several questions. First, how common are the symbolic uses of information technology—is this a major or a minor phenomenon? How effective are symbolic political strategies with various types of constituencies? How might the credible uses of computer simulations and IT-based analyses be distinguished from mainly symbolic uses? Which are the most effective alternative counter-strategies for political actors seeking to puncture the symbolic power of technology?

ORGANIZATIONAL BEHAVIOR ISSUES

The Issue of Impact on Discretion

Discretion is the employee-level view of the issue of power distribution. Will information technology mean that employees will have increased discretion, resting on better information shared more freely through networks? Zuboff (1988, 386) represents the optimistic side of empirical research on this question. Her study of drug company employees' use of a computer conference system concluded that "knowledge displayed itself as a collective resource; non-hierarchical bonds were strengthened; individuals were augmented by their participation in group life; work and play, productivity and learning, seemed ever more inseparable." Other authors in this optimistic tradition include Piore and Sabel (1984) and Heckscher (1994).

Cynthia West's (2001) work is indicative of findings of researchers who have taken the pessimistic view. Studying the "digerati," information technology workers, West found a general diminution of discretion, freedom, and privacy on the job as employers discovered and implemented new forms of electronic surveillance and accountability and, more important, as the "digerati" themselves embraced IT's immersive culture, willingly sacrificing even social and family freedoms to organizationally defined needs. Vallas (1993, 1999) has found that even major shifts in IT may do little to increase discretion and freedom, or to change organizational hierarchy. Other researchers have likewise found that while information technology may add conceptually complex content to jobs, this does not mean that the discretion of employees over this content is increased (Burris, 1998).

The Research Need. Information technology has the capacity to increase the access of public employees to various forms of expertise, enabling them to make better decisions across a wider array of topics, warranting increasing their level of discretion and freedom. Information technology also has the capacity to increase the intensity and closeness of supervision in ways hierarchically-oriented "Theory X" managers only dreamed of in the last century, severely eroding professional discretion and freedom. Again, which pole in this duality will prevail is an empirical research question. More broadly, research is needed to understand the dynamics of forces which under some contingencies tend toward increased discretion, and under other contingencies toward less.

The Issue of Impact on Organizational Culture

Information technology, intranets, and the Internet have the capacity to reinforce or to undermine organizational culture technologies (Hakken, 1993; Wilkinson, 1983; Dudley, 1994; Orr, 1997; Shields, 1997; Schoenberger, 1997). On the side of reinforcement is research such as that by Sproull and Kiesler (1991, 90), in which they found, "Respondents seem to believe that sharing information enhances the overall electronic community and leads to a richer information environment. The result is a kind of electronic altruism quite different from the fears that networks would weaken the social fabric of organizations."

However, this is not the full picture. Erosion of organizational culture may be a particular problem in public organizations, where fiscal austerity often means information systems are introduced in a more top-down manner with inadequate time for employee participation, testing, and buy-in (Caudron, 1997). In general, research on IT success has pointed to the paramount importance of organization development, leadership, training, and other human factors, yet at least in the public sector, these "soft" aspects of information systems are precisely the ones most likely to be neglected (Lynn, 2000). When they are neglected, the result may be "loss of control, social isolation and employee disappointment" (Brod, 1994, 39).

At the same time, those who are in control of technology implementation may represent a technocratic class within organizations, seeking to displace organizational culture with their own technocratic subculture. Vallas (2000) has found that new technologies provide new opportunities for professionally educated experts to enjoy new opportunities for the expansion of their power and autonomy, in a form of technocratic undermining of organizational culture. Vallas is in a long tradition of scholarship which argues that new technology reinforces elite culture within organizations, frequently at the expense of the less educated (Curtis, 1988; Derber & Schwartz, 1991; Burris, 1993; Reich, 1993; Aronowitz & DiFazio, 1995; Rifkin, 1995; Michaelson, 1996). Some authors have even gone so far as seeing IT as an instigator of a new form of class warfare within organizations (Perelman, 1998). In addition to the problem of the possible subversion of organizational culture to a technocratic subculture, there is also the problem of cultural corruption through "cyber-slacking" and Internet addiction (Marron, 2000; Lavoie & Pychyl, 2001).

The Research Need. The traditional Marxian analysis of technocrats saw them as hired guns of the capitalist class. Is there really a technocratic subculture in large organizations, and do technocrats seek to make this subculture the general organizational culture? Or in the end, are technocrats simply still hired tools of more powerful organizational interests and not an organizational force in their own right? Do intranets, systems approaches to work process, and other aspects of IT better socialize workers into acceptance of organizational goals and norms, or does this mode of management encourage disengagement from cultural commitment to the organization and instead promote an ethos of organizationally alienated pragmatic self-interest? These are the central research issues surrounding the question of information technology and organizational culture.

ORGANIZATIONAL DESIGN ISSUES

The Issue of Decentralization

That the information revolution of the computer era has reduced information costs drastically is the starting point of an argument made by Reschenthaler and Thompson (1996) about the impact of information technology specifically on public administration. They theorize that the effects of reduced information costs are:

(1) increased efficacy of market mechanisms vis-a-vis governmental services or regulation;
(2) increased efficacy of decentralized allocation of resources and after-the-fact control vis-a-vis centralized and before-the-fact controls (e.g., pushing decision making as low in the organization as possible); and
(3) increased efficacy of job-oriented process structures vis-a-vis broad functional structures (e.g., multidisciplinary teams working holistically rather than functional departments working sequentially).

These authors argue that information explosion in the financial sector lessens the need for governmental financial regulations to protect investors, that advances in information processing allow such things as pollution rights or airport landing rights to be securitized and bought and sold on the market, and that technology-based improvements in costing and pricing transportation and telecommunications services justify the deregulation of these industries. More generally, Reschenthaler and Thompson argue that information technology erodes economies of scale in administration, production, and marketing, giving even smaller organizations first-class management tools in each of these functional domains.

Authors such as Reschenthaler and Thompson see the technological tide pushing administrators, public ones included, toward increased span of control, reduced layers of management, and delegation of more power to computer-equipped front-line employees, and toward decentralization if not actual contracting-out of governmental services. There is an important empirical research question in determining if this dynamic does, in fact, exist. While the advent of desktop computing undeniably has brought striking decentralization in information systems, other researchers have seen a more complex picture characterized by a mix of centralization and decentralization, with the center maintaining critical controls over the decentralized periphery (Heeks, 2000).

Some see technology as a primarily centralizing force, reducing autonomy (Burris, 1998). Harris (2000) acknowledges that information technology facilitates intergovernmental cooperation, enabling the devolution of federal functions to the state level in the last quarter century, but federal functions remain massive in scale, while state functions have increased dramatically in scale. Most researchers who have looked at the governmental trends which Reschenthaler and Thompson cite have attributed them to a combination of the rise of conservative political forces in combination with an era of fiscal austerity economically, largely unrelated to trends in information technology (Liner, 1989). Others have attributed worldwide trends toward decentralization to the ascendency of a new philosophy of management (reinventing government, new governance, new public administration; see Bryson & Good, 1992; Peters & Pierre, 1998; Kettl, 2000; Salamon, 2002) whose time has come, in part, because information technology makes coordination under conditions of decentralization more possible.

The Research Need. Research is needed not to better describe how information technology increases the power of both the center and the periphery, but also to understand, where decentralization does occur, what are the several forces behind it and whether information technology is a determining factor or merely one of many supporting factors. If the latter, then change in the primary determinants (e.g., prevailing political ideology, state of the economy) may find information technology is not an independent dynamic in its own right but rather supports whatever direction, centralization or decentralization, which these primary determinants dictate.

The Issue of Privatization

For public administrationists, privatization is the extreme extension of decentralization. As in other areas of governance, the issue of possible privatization of public information systems is a controversial one calling for more research. Outsourcing is common in the private sector and has many longstanding examples, including the noteworthy rise of EDI and other firms handling health care transactions for both the private and public sector. Since then, outsourcing has become a routine "reform" favorite of state legislatures. The state of Connecticut has even made an attempt to privatize all governmental IT functions (Daniels, 1997).

The Research Need. While privatization and outsourcing are proposed as efficiency measures "to put government on a business-like basis," in truth there are only a few empirical research studies (such as Cohen, 2000) about when and under what circumstances this organizational design strategy actually improves efficiency or effectiveness and when it actually works in the opposite direction. Moreover, as Rocheleau (1999) notes, in the public sector, strategies of privatization and outsourcing are subject to the additional threats of political corruption and favoritism, not to mention the more generalized problems of goal displacement and lack of accountability, in the contracting-out process. Goal-displacement and even outright corruption in privatization and outsourcing are themselves important issues which are presently under-researched.

The Issue of Remote Work and the Span of Control

Information technology holds the potential to have profound effects on the way organizations, including government agencies, are designed. One of the most commonly mentioned possibilities is remote work and telecommuting. Remote work and telecommuting promise efficiencies in terms of nonmonetary job incentives for employees and in some cases major savings in the form of ability to forego capital construction as increased office space is no longer needed (Fulk & deSanctis, 1995). The reality of these promised developments remains largely unresearched.

Telecommuting from home has been found to be an isolating experience in most studies to date (Chapman, Sheehy, Heywood, Doolley & Collins, 1995; Fitzer, 1997), but not in all such studies (Belanger, 1999). Morgan and Symon (2002) note that e-mail and intranets can be used either to promote or to undermine organizational commitment and goal unity with respect to remote employees. A review of the literature on telework by Ellison (2000, 259) concluded that “telework has not come close to fulfilling early, exuberantly optimistic predictions of its adoption,” with employee isolation being the most important of several obstacles. Some studies suggest, however, that remote workers, in contrast to telecommuters, are less isolated and more integrated into the organization (Duxbury & Neufeld, 1999).

The Research Need. One of the major efficiency gains promised by information technology is the flattening of organizational hierarchies, as better information flow and control means that span of control can be increased, enabling the elimination of many middle management jobs. Increased span of control can be extended to remote work and even telecommuting, enabling possible further efficiencies. The research focus to date has been primarily on obstacles to remote work and telecommuting, particularly isolation. However, research is needed even more to study the underlying premise: does IT, in fact, increase the span of control, not just in principle but in the practice of public management? How widespread is organizational flattening and how do public managers seek to maintain control in the face of flatter organizations where this has come about? How do public managers seek to maintain control where IT-enabled changes lead to remote work and telework?

The Issue of Implementation Success Factors

Researchers have uncovered a large number of factors which underpin successful implementation of information technology projects. Garson (1995, 213-220) lists over 50 success factors identified in one research study or another, including product factors (software functionality, appropriate technology, standardization, user-friendliness, etc.), support factors (reputation, good marketing, top management support, placement of the IT unit in the decision-making inner circle, etc.), management factors (strong project manager, clear goals, good evaluation plan, client customization, process flexibility, team management, participative decision making, investment in training, etc.), and environmental factors (competitive pressures, growing resource base, dynamic environment, etc.). Many of these factors, and others, were uncovered in hundreds of interviews by students of Alana Northrop with public-sector IT officials, uncovering, for instance, the preeminent importance of direct top management support and leadership, and of investment in training (Northrop, 2001; see also Keen, 1991; Drucker, 1995; Martin, 1995; Coursey & Killingsworth, 2000), along with factors such as utilizing employee feedback, having a period of pretesting before implementation, having webpage support, and many more. A number of these factors go back to Newcomber and

Caudle's (1991) survey seeking to evaluate public-sector information technology projects.

As Brown (2000) points out, many success factors have to do with the extent to which the IT project has taken into account incentives for all the affected stakeholders to "buy into" the effort, operates under a clear goal structure (DeSeve, Pesachowitz, & Johnson, 1997) with clear milestones and measurable deliverables (Lucas, 1975; Flowers, 1996; Bowsher, 1997), is monitored with a good quality assurance program (Davis et al., 1992; Bowsher, 1994; Keil, 1995) with performance measures (Cohen, 2000), employs a team reflecting not only technical but also organizational and project management competencies teams (Keider, 1984; Regan & O'Connor, 1994), and uses outsourcing strategically but is not overdependent on outside contractors (Lacity, Willcocks, & Feeny, 1996; Martin, 1997; Brown & Brudney, 1998).

The Research Need. While it is always useful to do case studies, management opinion surveys, and otherwise gain additional information on implementation success factors, the present-day research need is more to develop middle-range contingency theory *relating* the factors which are already largely known. For instance, is it true that the more dynamic the environment, the more important participative decision making? Is it true that the more competitive the environment, the more important goal clarification? Is it true that the more user-friendly the software, the less the need for training? Under what conditions is a given success factor a prerequisite to successful implementation, not merely one more "plus." In general, research is needed on the relationship *between* pairs of success factors and eventually on the dynamic *among* multiple success factors. Such research will help advance the state-of-the-art from an enumeration of success factors in IT implementation to a theory of implementation.

WEBSITE DESIGN ISSUES

Persuasiveness of Governmental Websites

More research is needed to understand what makes some governmental websites more persuasive than others. Partly, of course, the majority of governmental websites do not even attempt to be persuasive, instead serving merely as an online version of a civic telephone directory and rack of forms (Scavo and Shi, 1999). Persuasiveness, however, is particularly salient to a number of areas (ex., public health, drug control, voter registration) where persuading citizens to alter behavior is a central element. Briggs, Burford, and

DeAngeli (2002) found that while Web design plays a role in forming a user's first impression, particularly for passive users, the persuasiveness of a website was related to *credibility* (demonstrating knowledge and expertise, appearing impartial, and ensuring information is accessible), *personalization* (interactive, such that advice can be tailored to the individual and users can make their own choices), and *predictability* (drawing on prior experience, reflecting users' knowledge and understanding, and containing the appropriate signs, statements, or logos) when considering if active users seeking advice will actually follow that advice. Of these three, credibility was the most important. The authors cited twelve specific success factors underlying persuasive websites, based on their review of the literature, noting each was related to credibility, personalization, or predictability:

1. Include seals of approval such as TRUSTe (Cheskin Research, 1999; Tan & Thoen, 2000).
2. Provide explanations, justifying the advice given (Egger, 2000).
3. Include independent peer evaluation such as references from past and current users and independent message boards (Schneiderman, 2000; Egger, 2000).
4. Include alternative views, including good links to independent sites within the same domain (Schneiderman, 2000).
5. Include background information such as indicators of expertise and patterns of past performance. (Egger, 2000; Olson & Olson, 2000; Fogg et al., 2001).
6. Ensure that communication remains open and responsive and offer alternative means of getting in touch (Egger, 2000).
7. Improve ease of use (Cheskin Research, 1999; Egger, 2000; Olson & Olson, 2000; Fogg et al., 2001).
8. Create a professional image, avoiding spelling mistakes and other simple errors (Egger, 2000; Fogg et al., 2001).
9. Convey a "real world" look and feel, for example with the use of real addresses and high quality photographs of real places and people (Fogg et al., 2001).
10. Provide clearly stated policies concerning security and privacy statements, rights to compensation and return, where appropriate (Cheskin Research, 1999; Irvine, 2000; Schneiderman, 2000; Egger, 2000).
11. Don't mix advertising and content—avoid sales pitches and banner advertisements (Fogg et al., 2001).
12. Offer a personalized service, which takes account of each user's needs and preferences (Egger, 2000).

Other studies of online trust include Cassell and Bickmore, 2000; Cheskin Research, 1999; Egger, 2000; Kim and Moon, 1998; Olson and Olson, 2000; Resnick et al., 2000; Schneiderman, 2000; and Tan and Thoen, 2000. Other studies of web credibility include Fogg and Tseng, 1999; Fogg et al., 2001; and Berdichevsky and Neuenschwander, 1999.

The Research Need. To date most researchers have focused on the extent to which public agencies present information via the Internet and on the types of information access provided. Of greater theoretical importance is research seeking to understand the persuasiveness of Web presence on citizen opinion and, more broadly, to understand the relative power (or impotence) of the Internet as a tool for organizations to affect their environment.

REGULATORY ISSUES

Regulating Social Vices

Information technology makes almost everything more accessible, including access to services which have traditionally been considered social vices (e.g., pornography, gambling, matching services for adultery, "escort" services, sales of recreational substances). While not necessarily illegal, these Internet-based services have evoked debate about regulatory policy. Griffiths and Parke (2002) found that Internet gambling was one of the fastest-growing aspects of information technology, tripling in scope since 1997 (see also Mitka, 2001). Sinclair (2000) predicted some 15 million Internet gamblers by 2004. Moreover, Griffiths and Parke found that the structural characteristics of the Internet make gambling significantly more convenient and enjoyable compared to traditional gambling. For instance, people gamble more using e-cash than they would with real cash (Griffiths, 1999). From the other end, Internet gambling firms can gather data better on a customer's preferences and thus provide tailored access. The implication of most studies to date is that authorities may anticipate increased potential for gambling and gambling addiction globally, and therefore increased need for Internet gambling regulation, a topic on which there appears to be almost no research to date. Much the same might be said of studies regarding other Internet-supported social vices.

The Research Need. Research is needed to benchmark the existing extent of Internet-enabled social vice; to forecast trends based on projections of growth of Internet access; and to understand which regulations are effective in achieving various goals (e.g., curtailment of use, taxation of use). In addition, legal research is needed to understand the application of paper-era court precedents to digital-era situations, along the lines of research by Biegel (2001).

Other forms of regulation

Biegel (2001) notes that in addition to social vices, there are a large number of other regulatory issues having to do with the advent of the Internet. Many of these have to do with the commercial world, including deceptive advertising, dishonest transactions, theft of intellectual property and copyright violation (Cole and Broucek, 2000), practicing medicine or other professions without a license, and sexual harassment on the job. Governments and corporations generally seek regulation of computer code which, as in the 1998 Digital Millennium Copyright Act, restricts the freedom and privacy of citizens of the cyber world, as traced by Lessig (1999) and others.

Yet other areas of regulatory concern include traditional subject of law such as defamation, invasion of privacy, hate speech, issuing threats, and malicious destruction of (cyber) property. As Biegel notes, there are essentially three strategies for regulation of these and other IT-related problems: regulations within individual countries, international agreements on regulation, and mandated changes in Internet-related server and other software code. In each substantive problem area, research is needed to assess what combination of these three strategies is needed.

The Research Need. In every specific policy arena one may research whether information technology is changing the dynamics of the policy process. In global environmental and development policies, does IT improve the effectiveness of environmental activists or of their opponents more? Does it promote cooperation or conflict more? Does it change policy outcomes? Similar research questions may be posed for policy arenas such as intellectual property, privacy protection, regional planning, mass transportation, social welfare, adult education, art and culture, Internet voting proposals, and any other policy domain which can be named.

SUMMARY

Like the Internet itself, social research on information technology is in its infancy. The would-be student is inundated with volumes of "look at this, look at that" descriptive literature and an equal amount of rose-colored optimistic IT salesmanship literature. Much of what passes for theory—much of systems theory is an example—is not theory at all in the sense of trying to specify the causal dynamics relating variables affecting IT processes, but is instead merely a vocabulary for ordering and describing such processes. Fortunately, research dimensions are emerging based on empirical research on theoretically important concepts. Without vainly aspiring toward a "general field theory" of information technology, it is still possible to focus on these theoretically important dimensions and thereby advance the state-of-the-art of research on information technology in the public sector and even in general. To achieve the next step, the level of mid-range theory, researchers must avoid the temptation to be mere publicists of technological novelty and possibility or social engineers studying how to coopt actors into acceptance of technological change. Researchers must instead return to their roots as social scientists, selecting the targets of study based on theoretical importance, operationally defining indicators of concepts, indexing these into latent variables, and modeling the relationship of these variables to one another.

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Appendix: Doing Online Research in Public Administration

INTRODUCTION

Today it is increasingly recognized that developing competencies in online research is a requirement for the training of professionals (Barry, 1997). Nowhere is this more true than in public administration research because the federal and other levels of government have taken the lead in online access to public records (Taylor, 1991; Stowers, 1996; Milward & Snyder, 1996; Reschenthaler and Thompson, 1996). As Roberta Balstad Miller has observed, information technology is providing unprecedented access to data as well as to the ability to analyze it (Miller, 1995). Traditional modes of data collection are destined to be replaced by electronic access to metadata and databases. Researchers will spend less time on data collection itself and will spend more time on analysis and interpretation. As electronic access reduces the cost of research the scope of research is expanding, as is online research collaboration.

In fact, so swift has been the rise in the significance of online research and the volume of use that by the mid-1990s, significant problems had arisen related to the scalability of existing research discovery tools. The Internet Research Task Force was established to study problems associated with the continued growth of data volume and data diversity. The Task Force has recommended ways to improve data retrieval, improve data servers, and upgrade searching algorithms (Bowman et al., 1994). Several government and corporate initiatives, including the National Information Infrastructure (NII) and Internet II, are now directed at assuring the viability of online access as a research tool. It is no exaggeration to say that national corporate and political leaders now see massive investment in the infrastructure for online research as the key to American research, development, and productivity competitiveness in the twenty-first century.

GENERIC SEARCHING ON THE WEB

GPO (Government Printing Office) access is available through many libraries (e.g., http://www.lib.ncsu.edu/stacks/gpo/), providing online access to a wide variety of government documents, including but not limited to:

- Blue Book (Overview and Compilation of US Trade Statutes)
- Budget of the United States
- Code of Federal Regulations
- Commerce Business Daily
- Congressional Bills
- Congressional Directory
- Congressional Documents
- Congressional Record
- Congressional Record Index
- Congressional Reports
- Department of the Interior Inspector General Reports
- Economic Indicators
- Economic Report of the President
- Federal Register
- General Accounting Office (GAO) Reports
- General Accounting Office (GAO) Comptroller General Decisions
- History of Bills and Resolutions
- Public Laws
- Supreme Court Decisions
- US Government Manual
- United States Code
- Weekly Compilation of Presidential Documents

Apart from the GPO, numerous web sites specialize in providing gateways to federal government information:

- http://www.whitehouse.gov/WH/Cabinet/html/cabinet_links.html, The Cabinet Departments
- http://www.catalaw.com, CataLaw Legislation Locator
- http://www.access.gpo.gov/nara/cfr/cfr-table-search.html, Code of Federal Regulations, National Archives and Records Administration
- http://www.house.gov/govsites.html, Federal Government Resources, US House
- http://www.lib.lsu.edu/gov/fedgov.html, Federal Government Websites, LSU
- http://www.whitehouse.gov/WH/Independent_Agencies/html/independent_links.html, Federal Independent Agencies and Commissions
- http://fic.info.gov/, Federal Information Center
- http://thomas.loc.gov/, Federal Legislation from the US Congress Library
- http://www.access.gpo.gov/su_docs/aces/aces140.html, Federal Register
- http://medoc.gdb.org/best/fed-fund.html, Federal Research Info Online
- http://www.law.vill.edu/fed-agency/fedwebloc.html, Federal Web Locator
- http://www.fie.com/www/us_gov.htm, Federal Web Servers
- http://www.fedworld.gov/, FedWorld
- http://cobar.cs.umass.edu/ciirdemo/Govbot/, Govbot Keyword Search
- http://www.yahoo.com/Government/Indices/, Government Indices, Yahoo
- http://www.nara.gov/gils/gils.html, Government Information Locator Service
- http://www.info.gov/, Government Information XChange
- http://www.nasire.org/, StateSearch

Another set of web sites specialize in providing gateways to state-level governmental information:

- http://www.csg.org, The Council of State Governments
- http://web.fie.com/index.htm, FEDIX
- http://www.governing.com/, Governing (State and Local Government)
- http://www.gol.org, Government Online
- http://ksgwww.harvard.edu/~library/states.htm, Harvard's Kennedy School of Government, State and Local Page
- http://www.ncsl.org, National Conference of State Legislatures (NCSL)

- http://www.ncsl.org/public/sitesgov.htm, NCSL Policy Sites Page
- http://libertynet.org/community/phila/natl.html, Neighborhoods Online
- http://www.statelocal.gov/, State and Local Gateway
- http://www.piperinfo.com/state/states.html, State and Local Government on the Web
- http://www.law.indiana.edu/law/v-lib/states.html, State Government Web Sites
- http://www.nasire.org, StateSearch
- http://oyez.at.nwu.edu/cases/subject-index.html#federalism, Supreme Court Cases on Federalism
- http://sunsite.unc.edu/usa/usahome.html, The USA Home Page

In addition, generic online searching in public administration can be accomplished through any of the large number of web search engines. AltaVista (http://www.altavista.com) is perhaps the leading such engine, and others include Yahoo (http://www.yahoo.com), Excite (http://www.excite.com), Lycos (http://www.lycos.com), and WebCrawler (http://www.webcrawler.com). All accept keyword searching and some, such as Yahoo, actively organize pages of web links on selected topics, some of which are related to public administration concerns.

Besides websites, there are also thousands of electronic discussion groups, often called listservs or just lists, many on topics of interest to public administration. One may search for these discussion groups through Liszt (http://www.liszt.com/) or search by keyword the contents of any and all discussion groups through DejaNews (http://www.dejanews.com/).

COMMON GOVERNMENTAL WEBSITE DESTINATIONS

Of course, the federal agencies themselves all have websites providing a wealth of research information. Among the most common governmental website destinations are these:

- http://www.uscourts.gov/, Administrative Office of the U.S. Courts
- http://www.ojp.usdoj.gov/bjs/, Bureau of Justice Statistics
- http://stats.bls.gov/blshome.html, Bureau of Labor Statistics
- http://www.odci.gov/cia/, Central Intelligence Agency
- http://www.census.gov, Census Bureau

- http://www.doc.gov/, Commerce Department
- http://www.senate.gov/~budget/republican/, Committee on the Budget, US Senate
- http://www.doe.gov, Energy
- http://www.epa.gov, Environmental Protection Agency
- http://www.access.gpo.gov/su_docs/budget/index.html, The Federal Budget
- http://www.fbi.gov, Federal Bureau of Investigation
- http://www.fcc.gov/, Federal Communications Commission
- http://www.fdic.gov/, Federal Deposit Insurance Corporation
- http://www.fec.gov, Federal Election Commission
- http://www.fjc.gov/, Federal Judicial Center
- http://www.ftc.gov/, Federal Trade Commission
- http://www.financenet.gov/, FinanceNet
- http://www.gsa.gov, General Services Administration
- http://www.access.gpo.gov/su_docs/, Government Printing Office
- http://ssdc.ucsd.edu/gpo/, Government Printing Office Access, including Federal Register
- http://www.os.dhhs.gov, Health and Human Services, Department of
- http://www.hud.gov/, Housing and Urban Development, Department of
- http://amcom.aspensys.com/huduser/, HUD User Databases
- http://www.huduser.org/, HUD User
- http://www.usdoj.gov/, Justice Department
- http://www.fpmi.com/MSPB/MSPBhomepage.html, Merit Systems Protection Board
- http://www.hq.nasa.gov/, National Aeronautics and Space Administration
- http://www.nara.gov, National Archives and Records Administration
- http://www.nlrb.gov/, National Labor Relations Board
- http://www.npr.gov/, National Performance Review (“Reinventing Government”)
- http://www.nsf.gov, National Science Foundation
- http://www.nsa.gov:8080, National Security Administration
- http://www.osha.gov/, Occupational Safety and Health Administration
- http://www.whitehouse.gov/WH/EOP/omb, Office of Management and Budget
- http://www.opm.gov/, Office of Personnel Management
- http://adams.patriot.net/~permail/, Public Employees Roundtable
- http://www.state.gov/, State Department

- http://www.ustreas.gov/, Treasury Department
- http://www.gpo.ucop.edu/search/govman.html, US Government Manual Search
- http://www.usia.gov, US Information Agency
- http://www.usoge.gov/, US Office of Government Ethics
- http://www.usps.gov/, US Postal Service
- http://www.ussc.gov/, US Sentencing Commission

ACADEMIC WEBSITES IN PUBLIC ADMINISTRATION

In addition to agency websites, academia provides its own array of destinations valuable for public administration research, including these common destinations:

- http://www.aom.pace.edu/websites/index.html, Academy of Management
- http://www.apsanet.org/, American Political Science Association
- http://www.fsu.edu/~spap/orgs/apsa.html, American Political Science Association Policy Section
- http://www.aspanet.org/, American Society for Public Administration (ASPA)
- http://qsilver.queensu.ca/~appamwww/index.html, Association for Public Policy Analysis and Management
- http://www.wvu.edu/~socialwk/A/arnova.html, Association for Research on Nonprofit Organizations and Voluntary Action
- http://www.nmc.csulb.edu/users/publicadmin/, Charting a Course in Public Administration
- http://www.cox.smu.edu/mis/cases/home.html, Cases in MIS: Edwin L. Cox School
- http://www.hallway.org, Electronic Hallway: Cases and Teaching Resources for Public Policy and Management (University of Washington)
- http://cid.unomaha.edu/~wwwpa/fsite.html, Finance Administration Web Sites
- http://sfswww.georgetown.edu/sfs/programs/isd/files/pub.htm, Georgetown University's Case Collection
- http://english.hss.cmu.edu/Govt/, Government, Law, and Society Server, Carnegie-Mellon University

- http://www.hbsp.harvard.edu/homepage.html, Harvard Business School Publishing
- http://ksgwww.harvard.edu/~innovat/, Innovations in American Government
- http://www.willamette.org/ipmn/, International Public Management Network
- http://www.uakron.edu/paus/africa.html, Journal of African Public Policy
- http://www.uakron.edu/paus/pae.html, Journal of Public Administration Education
- http://ksgwww.harvard.edu/caseweb/, Kennedy School of Government Case Studies
- http://www.unomaha.edu/~wwwpa/parost.html, MPA Program Web Sites
- http://www.unomaha.edu/~wwwpa/nashome.html, National Association of Schools of Public Affairs and Administration
- http://garnet.berkeley.edu:3333/budget/budget.html, National Budget Simulation
- http://www.hbg.psu.edu/Faculty/jxr11/, <i>Public Administration and Management: An Interactive Journal</i>
- http://www.niu.edu/ext/par/, Public Administration Review
- http://deming.eng.clemson.edu/pub/psci/, Public Sector Network
- http://unicron.unomaha.edu/faculty/cbayer/web/npomarks.htm, Web Sites for Nonprofit Managers
- http://www.yale.edu/isps/ponpo/pubs/casesnpg.html, Yale: Cases in Nonprofit Governance
- http://www.gol.org/bestof.html, Best of Practice Government Solutions
- http://www.brook.edu/, Brookings Institution
- http://www.capaccess.org/, CapAccess, The National Capital Area Public Access Network
- http://www.civiced.org, Center for Civic Education
- http://www.civic.net:2401/, Center for Civic Networking (related to the emerging National Information Infrastructure)

NGO WEBSITES

Non-governmental organizations provide yet more websites useful for public administration research, beyond those from federal agencies and from universities. Leading NGO sites include the following:

- http://www.city.net, City Net
- http://comm-dev.org, Community Development Society
- http://www.compa.org, Conference of Minority Public Administrators
- http://www.csg.org, Council of State Governments
- http://medoc.gdb.org/best/fed-fund.html, Federally Funded Research
- http://www.govtech.net, Government Technology Homepage
- http://www.ipma-hr.org/, International Personnel Management Association
- http://www.ncl.org/ncl/, National Civic League
- http://www.urban.org/, The Urban Institute

PUBLIC POLICY SITES

Each public policy arena has a large set of websites, too numerous to list here. However, common public policy gateway sites for the researcher include the following:

- http://www.fsu.edu/~spap/orgs/apsa.html, American Political Science Association, Policy Section
- http://www.brook.edu, Brookings Institution
- http://www.brook.edu/, Brookings Institution
- http://www.cato.org/, CATO Institute
- http://www.epn.org/, Electronic Policy Network
- http://essential.org/, Essential Information
- http://www.fedworld.gov/, FedWorld
- http://www.igc.org/an/, Institute for Alternative Journalism
- http://www.ipi.org/, Institute for Policy Innovation
- http://ksgwww.harvard.edu/~ksgpress/opinhome.htm, Kennedy School of Government
- http://www.unomaha.edu/~wwwpa/nashome.html, National Association of Schools of Public Affairs and Administration
- http://garnet.berkeley.edu:3333/budget/budget.html, National Budget Simulation
- http://nces.ed.gov/, National Center for Education Statistics
- http://www.nationalcenter.inter.net/, National Center for Public Policy Research
- http://www.ncsl.org, National Conference of State Legislatures (NCSL)
- http://www.now.org/, National Organization of Women
- http://www.npr.gov/, National Performance Review

- http://www.whitehouse.gov/WH/EOP/omb, Office of Management and Budget
- http://spirit.lib.uconn.edu/PoliSci/polisci.htm#WWW_Academic, Political Science Departments
- http://www.lgu.ac.uk/psa/psa.html, Political Studies Association (UK)
- http://www.hhh.umn.edu/PUBPOL/, PubPol Public Policy Archives
- http://www.rand.org/, Rand Corporation
- http://www.clearlake.ibm.com/Alliance/regodata.html, Reinventing Government Database (REGO)
- http://www.thinktank.com/thnklnk.html, ThinkLink
- http://law.house.gov/, US Code of Federal Regulations/Internet Law Library
- http://www.urban.org/, Urban Institute
- http://ksgwww.harvard.edu/~library/resorgs.htm, Other Policy Think Tanks and Resources

Crime Policy

- http://www.crime-prevention-intl.org, International Centre for the Prevention of Crime
- http://www.criminaljustice.org/PUBLIC/clinks.htm, National Association of Criminal Defense Lawyers Research Links
- http://www.public-policy.org/~ncpa/pi/crime/crime3.html, National Center for Policy Analysis: Crime Policy
- http://www.ncjrs.org/homepage.htm, National Criminal Justice Reference Service (NCJRS)
- http://www.rand.org/publications/RRR/RRR.spring95.crime/, RAND Corporation Crime and Drug Projects
- Economic Policy
- http://www.cyberpoint.co.uk/asi/, Adam Smith Institute (UK)
- http://www.cbo.gov/index.cfm, Budgetary Policy: The Congressional Budget Office
- http://www.whitehouse.gov/WH/EOP/OMB/html/ombhome.html, Budgetary Policy: The Office of Management and Budget
- http://domino.stat-usa.gov/, Commerce Dept. Stat-USA
- http://www.inficad.com/~cbolton/econ.html, Economic Policy—A Libertarian Viewpoint
- http://ecolan.sbs.ohio-state.edu/links.html, Economics Information Center, Ohio State University

- http://econwpa.wustl.edu/Welcome.html, Economics Working Paper Archive</A >
- http://www.bog.frb.fed.us/, Federal Reserve Board
- http://www2.tax.org/taxhistory/Documents/Fiscal/fiscal.htm, Fiscal Policy, Tax History Project
- http://weber.u.washington.edu/~fpcweb/, Fiscal Policy Center, University of Washington
- http://www.cato.org/research/fiscal.html, Fiscal Policy Studies, Cato Institute
- http://epn.org/idea/economy.html, Idea Central: Economics and Politics
- http://www.ita.doc.gov, International Trade Administration
- http://woodrow.mpls.frb.fed.us/info/policy/, Monetary Policy, Federal Reserve Bank
- http://www.financenet.gov/financenet/start/topic/private.htm, Privatization Resources, FinanceNet
- http://www.eden.com/~reporter/, The Progressive Populist
- http://www.regpolicy.com/, Regulatory Policy Center (focus on property rights)
- http://www.worldbank.org, World Bank
- http://www.worldbank.org/html/prddr/prdhome/prddr.htm, World Bank Policy Research Department
- http://www.yahoo.com/Social_Science/Economics/, Yahoo Economics Links

Education Policy

- http://www.aasa.org/index.html, American Association of School Administrators Home Page
- http://www.aft.org/index.htm, American Federation of Teachers
- http://www.coe.memphis.edu/coe/CREP/crep.html, Center for Research in Educational Policy
- http://csr.syr.edu/, Charter School Research
- http://www.whitehouse.gov/WH/New/html/educationfact.html, Clinton National Testing Standards Proposal FAQ
- http://www.collegeboard.org/index_this/grn/html/lcposits.html, College Board's Legislative Priorities
- http://csl.wednet.edu/, Commission on Student Learning
- http://olam.ed.asu.edu/epaa/, Educational Policy Analysis Archives
- http://home.aisr.brown.edu/ces/publicat/horace/v06n02.htm, Educational Policy and the Essential School, HORACE, Brown University

- http://www.nassp.org/, National Association of Secondary School Principals' Home Page
- http://www.nea.org/, National Education Association
- http://www.colostate.edu/Orgs/NREA/, National Rural Education Association
- http://www.nsba.org/, National School Boards Association
- http://www.cel.mcgill.ca/orep/default.html, Office of Research on Educational Policy
- http://www.ncrel.org/sdrs/pathwayg.htm, Pathways to School Improvement, North Central Regional Educational Laboratory

Health Policy

- http://www.aarp.org, American Association of Retired Persons
- news:bit.listserv.ada-law, Americans with Disabilities News Server
- http://www.ama-assn.org/, American Medical Association
- http://lhcwww.soph.uab.edu/, Center for Health Policy, University of Alabama-Birmingham
- http://www.whitehouse.gov/WH/Publications/html/WH-Major-Docs.html, Clinton Health Security Act
- http://epn.org/idea/health1.html, IdeaCentral, Health Policy Page
- http://www.cdc.gov/nchswww/index.htm, National Center for Health Statistics
- http://www.uab.edu/pedinfo/Government.html, Pedinfo: Government Agencies and Policy for Children's Health

Tax Policy

- http://www.irs.ustreas.gov/prod/cover.html, IRS Digital Daily
- http://www.taxsites.com/policy.html, Links to Tax Policy Groups
- http://omer.actg.uic.edu/, Tax World
- http://omer.actg.uic.edu/othersites/stateinfo.html, States' Tax Policies
- http://www.taxhistory.org/, Tax History Project
- http://www.accf.org/TaxPolAn.htm, Tax Policy Analysis, American Council for Capital Formation
- http://www.ustreas.gov/treasury/browse/tax.htm, Tax Policy Page, Dept. of the Treasury
- http://shell5.ba.best.com/~ftmexpat/html/taxsites/proposed.html, Tax Policy Sites

Welfare Policy

- http://www.apwa.org/index.htm, American Public Welfare Association
- http://stats.bls.gov/news.release/empsit.toc.htm, Bureau of Labor Statistics News Releases
- http://www.afj.org/mem/welflaw.html, Center for Social Welfare Policy and Law
- http://aspe.os.dhhs.gov/hsp/isphome.htm, Department of Health and Human Services, Economic Support for Families Page
- http://www.handsnet.org/handsnet2/welfare.reform/, Handsnet Welfare Reform Watch
- http://www.acf.dhhs.gov/programs/hsb/index.htm, Head Start
- http://epn.org/idea/welf-bkm.html, Idea Central, Welfare Reform Links
- http://nch.ari.net/, National Coalition for the Homeless
- http://www.census.gov/hhes/www/poverty.html, Poverty Statistics, US Census
- http://www.ssa.gov, Social Security Administration
- http://thomas.loc.gov/cgi-bin/bdquery/z?d104:HR00004:, Welfare Reform Legislation (1996)

DATA-RELATED SITES

In terms of generic searching for data on the Internet, there are a large number of websites which are pertinent to data-oriented public administration research:

Statistical data:

- http://www.census.gov, Bureau of the Census
- http://www.icpsr.umich.edu/gss/,General Social Survey (GSS) Home Page at the ICPSR
- http://www.icpsr.umich.edu/gss/search.htm, Search the General Social Survey
- http://www.lib.umich.edu/libhome/Documents.center/stats.html, University of Michigan Statistics Page
- http://www.lib.virginia.edu/socsci/, Social Sciences Data Center
- http://www.ntu.edu.sg/library/statdata.htm, Statistical Data Locators
- http://odwin.ucsd.edu/jj/idata/index.html, UCSD Searchable Listing of Social Science Data Sources
- http://www.stat-usa.gov/, Stat-USA (Commerce Department)
- http://www.cudenver.edu/psrp/psrp.html, Political Science Research Page

Poll data:

- http://www.gallup.com/,Gallup Organization
- http://www.unc.edu/depts/irss/, IRSS Home Page
- http://www.irss.unc.edu:80/data_archive/, IRSS Data Archive
- http://www.irss.unc.edu:80/data_archive/pollsearch.html, Search
- http://www.louisharris.com/home_content.html, Louis Harris and Associates
- http://www.isr.umich.edu/src/, University of Michigan Survey Research Center
- http://www.lib.umich.edu/libhome/Documents.center/opinion.html, University of Michigan Library: Public Opinion
- http://www.princeton.edu/~abelson/index.html, Princeton Survey Research Center
- http://www.ropercenter.uconn.edu/, Roper Center for Public Opinion Research, including POLL (also available in Dialog, discussed on the next page)
- http://www.nsd.uib.no/cessda/namer.html, Social Science Data Archives—North America
- http://ssdc.ucsd.edu/ssdc/pubopin.html, Social Science Data Collection, from UCSD
- http://polecat.iupui.edu/pol/links/links.html, More Polling Links

EXPLORING CENSUS DATA

Census Access

A very wide and changing variety of data pertinent to public administration are available online through the Census.

Approximately 300 Census CD-ROMs are available online at http://cedr.lbl.gov/cdrom/doc/cdrom.html, by arrangement with the University of California. Once Census data have been downloaded, the problem becomes one of putting it in a format which is useful. The Census provides free, downloadable software for this purpose. *Extract,* located at http://www.census.gov/main/www/epcd/www/extract.html, is the general purpose PC-based data display and extraction tool that works with Census Bureau CD-ROMs recorded in dBASE format.

Integrated Public Use Microdata Series (IPUMS) data, the richest source of time series census data, are made available through the University of Minnesota at http://www.ipums.umn.edu/ (IPUMS-98 home page) and http://www.ipums.umn.edu/~ipums/index1.html (IPUMS-95 home page). IPUMS was created at the University of Minnesota and consists of 25 samples of the American population drawn from thirteen federal censuses from 1850 to 1990, using uniform codes across all the samples and providing documentation. It includes nearly everything originally recorded with the principal exception being that due to confidentiality laws applying to years from 1940 on, no names, addresses or other identifying information are included. Moreover, samples from 1940 on include only geographic areas with 100,000 inhabitants or more (250,000 in 1960 and 1970). The 1850 and 1860 samples exclude the slave population. The pre-1890 samples exclude "Indians not taxed." The pre-1960 samples, except 1900 and 1910, exclude Alaska and Hawaii. Samples since 1970 include unoccupied housing units. Variables include fertility, nuptiality, life-course transitions, immigration, internal migration, labor-force participation, occupational structure, education, ethnicity, and household composition. Since 1960, detailed housing characteristics are also included. *Extract* software, referenced above, is used in conjunction with IPUMS data.

SIPP, the Survey of Income and Program Participation, is made available online through the ACCESS project, described by Robbin (1992).

The Government Information Sharing Project, discussed below, provides links to a variety of Census resources at http://govinfo.kerr.orst.edu/. At the time of this writing, links included USA Counties 1996 (including GIS choropleth maps for selected variables), 1992 Economic Census, US Import-Export History, Regional Economic Information System, Consolidated Federal Funds Report, Earnings by Education and Occupation, Population Estimates by Age, Sex, and Race, and more.

The 1990 Census Lookup allows the user to create his or her own extract files, located at http://venus.census.gov/cdrom/lookup.

The Ferret Data Extraction and Review Tool provides another method of obtaining Census data extracts, located at http://ferret.bls.census.gov/cgi-bin/ferret.

The Data Extraction System (DES), also known as Surveys-on-Call, also creates custom data extracts at MABLE/GeoCorr, the Census's Geographic Correspondence Engine, located at http://www.census.gov/main/www/DES/www/welcome.html.

MapStats is an online guide to data profiling the states and counties, located at http://www.census.gov/main/www/datamap/www/index.html.

The Tiger Map Server allows the user to generate detailed maps on-the-fly, located at http://tiger.census.gov/cgi-bin/mapsurfer. The Tiger Map Server requires Netscape 2.0 or higher.

Direct file access to Census files is available using file transfer protocol at ftp://ftp.census.gov/pub/.

MABLE/GeoCorr is the Census's Geographic Correspondence Engine, located at http://www.census.gov/main/www/plue.

The US Gazetteer provides place name and ZIP code searches, located at http://www.census.gov/cgi-bin/gazetteer.

State Data Center (SDC) and Business and Industry Data Center (BIDC) Programs

The Bureau of the Census's State Data Center (SDC) Program was established in 1978 to provide training and technical assistance in use of census materials by educators, researchers, business, and government. Later, in 1988, the Business and Industry Data Center (BIDC) Program was added to provide specific support for the business community, but it is also useful for academic and other researchers engaged in business-related work. Both SDC and BIDC websites contain a wide variety of general and state-specific data resources, with emphasis on census materials.

LEGISLATIVE AND LEGAL ONLINE RESEARCH

Legislative and legal research has been dominated by electronic modalities since the 1980s (Hubbard, 1982; Maclay, 1989). As in the area of bibliographic searching, some legislative and legal research may be done for free on the web, but recurrent use will warrant subscription to an online service. The leading example of such a general service is Lexis-Nexis, whose home page is http://www.lexis.com/. In the more specific area of citation research, the leading service, also fee-based, is West (Beckman & Hirsch, 1997). West Publishing Group's electronic research system, KeyCite, is only available online to maintain its currency, reflecting a sea-change in research. In one area after another, online access is becoming the modality of choice. KeyCite's graphical interface supports hypertext links to cases, case histories, precedent cases, and other authorities. From a cost viewpoint, even a modest research program could easily spend thousands of dollars a year for either the West or Lexis-Nexis service, but some law schools and bar associations will arrange for access to databases on a fee-for-use basis, and some research university libraries make them available for fee or free to faculty and graduate students.

Although fee-based services provide the best and most comprehensive access for legislative and legal research, a variety of free online research tools also exist, such as FindLaw (Quinn, 1997; Healey, 1997).

The US Code itself is available online from Cornell University, at http://www.law.cornell.edu/uscode/.

The US Congress "Thomas" website, at http://thomas.loc.gov/, supports keyword searching for bills, laws, Congressional Record, committee documents, US government links, and more.

NCJRS is the National Institute of Justice's National Criminal Justice Reference Service. Its purpose is to share information about criminal justice research and evaluation, work, statistical analysis, policy, and programs.

UNOJUST is the United Nation's On-line Crime and Justice Clearinghouse. Supported by the NCJRS, which has had extensive relationships with the international community, the United Nations Crime Prevention and Criminal Justice Branch asked NIJ (National Institute of Justice) to assist in designing the prototype of an Internet-based system of information exchange (Lively, 1995). The outcome, UNOJUST, is based on a structured approach intended to link each of its 13 institutes via the Internet in order to support research on crime and justice.

NEWS RESEARCH ONLINE

Computer-assisted reporting has become an important tool for newspaper reporters in the 1990s. A University of Miami study revealed that such usage at newspapers from 1995 to 1996 was most pervasive in areas of interest to public administration, including local government, politics and election, and policy areas such as education (Garrison, 1997). In fact, government information was among the most common subject of online searches by newspaper reporters.

Many newspapers have their own online access services, some free, some not. Also, database vending services such as Dialog (discussed below) provide another avenue for news-clipping searching. If one can be satisfied with shorter articles and limited but still very extensive general news coverage, Pointcast (http://www.pointcast.com) provides a free service through which one can access both general news sources (ex., *Washington Post, New York Times,* CNN, *Time*) and specialized ones, including a range of governmental sources (e.g., congressional committee materials, *Federal Register*).

GEOGRAPHIC DATA ONLINE

Most agencies now use mapping in one form or another. Fortunately, online access to geographic data has expanded, as has online access of text or statistics. Some leading web sites are listed below:

Government sites

- http://www.dma.gov/, Defense Mapping Agency
- http://www-nmd.usgs.gov/www/gnis/, Geographic Names Information System, USGS
- http://images.jsc.nasa.gov/, National Aeronautics and Space Administration Digital Image Collection (NASA)
- http://164.214.2.59/index.html, National Imaging and Mapping Agency (NIMA)
- http://www.noaa.gov/, National Oceanic and Atmospheric Administration (NOAA)
- http://www.bts.gov/gis/links/links.html, Transportation Department GIS Links
- http://www.census.gov/main/www/access.html, US Census Online Mapping Tools
- http://info.er.usgs.gov/, US Geological Survey (USGS)
- http://www.govtech.net/services/connections/gis.shtm, State GIS Programs and other GIS Resources

Educational and Professional Sites

- http://www.aag.org/, Association of American Geographers (AAG)
- http://wings.buffalo.edu/geoweb/services.html, GeoWeb GIS Links
- http://geog.gmu.edu/gess/jwc/cart2.html, Index of Cartographic Resources
- http://www.urisa.org/, Urban and Regional Information Systems Association (URISA)

Vendor Sites

- http://www.esri.com/, ArcView at ESRI
- http://campus.esri.com/campus/home/home.cfm, ESRI Virtual Campus
- http://www.esri.com/base/data/catalog/type.html, ArcView-Format Data Vendors

PUBLIC-SECTOR LABOR RESEARCH

Most public-sector unions have extensive websites, which can be a valuable aid in labor relations research:

- http://www.unionpride.com/afgeWWWnetwork.shtml, American Federation of Government Employees
- http://www.afge.org/history/history.htm, A History of American Federation of Government Employees
- http://www.afscme.org, American Federation of State, County, & Municipal Employees (AFL-CIO)
- http://www.apwu.org, American Postal Workers Union (AFL-CIO)
- http://www.mailhandlers.org, National Postal Mail Handlers Union
- http://www.nalc.org, National Association of Letter Carriers (AFL-CIO)
- http://www.natca.org, National Air Traffic Controllers Association
- http://www.natcavoice.org/, National Air Traffic Controllers Assn. Newsletter
- http://www.nteu.org, National Treasury Employees Union

BIBLIOGRAPHIC RESEARCH ONLINE

In addition to online data-oriented research, public administrators, like other scholars, often need to engage in bibliographic research to determine what other work and analysis has been done in a given area. Although a limited amount of bibliographic searching may be done free on the web, agencies and educational institutions which have a recurrent need in this area will almost certainly find it cost beneficial to subscribe to a fee-based online service such as Dialog, the nation's leading vendor of bibliographic and full-text databases. This is also true when searching for national, regional, and local news clippings on a given topic.

If bibliographic research is to be undertaken on a regular basis, a preliminary step is arming oneself with bibliographic data management software. ProCite and its companion products, BiblioLinks, and BookWhere?, are leading examples which complement searching on the web or on Dialog. ProCite stores citations in a database and can print them out in any format. Bibliolinks automatically takes Dialog and other downloaded information and sticks citations in a ProCite database. BookWhere? automatically goes out over the Internet to download citations from college libraries and the Library of Congress and puts the finds in a ProCite database. ProCite also installs itself as a tool in WordPerfect or Word so you can "cite while you write," adding the references for any author or subject you highlight, based on searching the ProCite bibliographic database.

Searching with Dialog

Dialog makes available several hundred databases, many of them bibliographic in nature. These include Public Affairs Information Service (PAIS), the leading general-purpose public administration bibliographic resource. Others include Sociological Abstracts, Criminal Justice Abstracts, Dissertation Abstracts, Books in Print, and most bibliographic reference sources one would encounter in the reference section of a university library. One may also access leading national and regional newspapers, trade journals, and a limited amount of numeric data (CenData, with Census data; and POLL, the Roper Center's database of almost every survey item ever published, not only by Roper, but also by Gallup, NYT, ABC, and many others). Details on each database are found in "Dialog Bluesheets," which are available online at http://www.krinfo.com/dialog/krinfo/bluesheets.html. To get to Dialog itself, one uses telnet to the address telnet://dialog.com. Telnet will require one has first obtained an account number and password from the Knight-Ridder Corporation, the owners of Dialog. Help in using the Dialog system is available online at http://www.krinfo.com/search/dir_search.html.

The first step in Dialog searching is selecting the databases you want from among the several hundred available. Though there are certain pre-selected groups of database, such as the GOVT government databases list or the PUBAFF public affairs list, use of these is very apt to be inefficient, including many databases of marginal interest. Instead, one will usually be better off by investigating the available databases through one of two paths. The Dialog "Blue Sheets" are available free online and contain descriptions of the features of each database, along with a sample record. Alternatively, one can invoke the "DialIndex" database, which contains metadata on all the others. After entering keywords into DialIndex, the researcher will be presented with the number of hits (matches) available in each database, ranked by frequency, thereby enabling the researcher to select the databases which are likely to be closest to his or her interests.

Commonly selected data files on Dialog include those listed below. In each case there is an associated file number (e.g., 1 for the ERIC database). These file numbers are used to actually invoke a database in an online session. DialIndex, mentioned above, is file number 411, and Dialog Blue Sheets is file 415.

File No.	Name
1	ERIC, educational and general coverage
11	PsychInfo, the leading bibliographic source in psychology

21	NCJRS, leading criminal justice source
22	Employee Benefits Infosource, on personnel
35	Dissertation Abstracts Online
37	Sociological Abstracts, the leading sociology source
38	America: History and Life
39	Historical Abstracts, the leading history source
40	Enviroline, one of several environmental databases
41	Pollution Abstracts
47	Magazine Index, general coverage
64	Child Abuse, Neglect, & Family Violence
68	Environmental Bibliography
75	Management Contents
86	Mental Health Abstracts
93	Public Affairs Information Service, the leading public administration source
122	Harvard Business Review
135	Congressional Record Abstracts
137	Book Review Index
139	Economic Literature Index
150	Legal Resource Index, for law articles (not citations)
163	Ageline, covering human services for the elderly
166	GPO Publications Reference Index
171	Criminal Justice Periodical Index
202	Information Science Abstracts
291	Family Resources
415	Dialog Blue Sheets
468	Public Opinion Online (POLL), from the Roper Center, covering not only Roper but also Gallup, Yankelovich, and most other opinion polls (frequency data, no cross-tabulations)
470	Books in Print
580	CENDATA, providing Census data in tabular form

Numerous other databases are available, including some of interest to public administration, such as the National Technical Information Service (NTIS), which covers all federally funded research.

To go online with Dialog one must prearrange an account number and password, since this is a fee service. One can connect to Dialog (as of 1998) by using Telnet software to go to the address dialog.com. After entering the account number and password, the researcher can choose between a menu mode and a command mode. Typing /MENU at command mode "?" prompt invokes the menu system. Typing /NOMENU at a menu system "?" prompt returns one to the command mode.

The command mode can be executed successfully with a half dozen commands. There are five basic steps:

1. First, the researcher invokes the desired databases with the "B" (Begin) command, as for example, "B 1,35,37" (but without the quote marks) to invoke ERIC, Dissertation Abstracts, and Sociological Abstracts simultaneously. Predefined sets can also be invoked in the same way, for example, B GOVT. Other predefined sets include BOOKS, BUSECON, BUSSTAT, EDUCAT, ENERGY, ENVIRON, HUMANIT, INFOSCI, LABOR, LAW, MANAGE, NEWSWIRE, PAPERS, PSYCH, PUBAFF, and SOCSCI.
2. Second, one enters one's keywords. A common strategy is to define each dimension separately, generating a set for each dimension, then asking for the intersection of the sets. For instance, a "government" dimension might include terms like government, public, federal, city, state, municipal, and so on. A "management" dimension might include terms like management, administration, and supervision. There may be several such dimensions. Root terms can be entered with a question mark wildcard: supervis? will get supervise, supervision, supervisor, etc. Phrases can be entered with the "w" operator: public(w1)policy, for instance, gets hits in which the two words are within one word of each other. One can also enter predefined descriptor terms found in the database's dictionary, or found in the descriptor portion of previous hits which have been displayed or printed. The actual request for the keywords is implemented with the "S" search command: S manage? or administ? or supervis?, to get the management dimension. Dialog will list the number of matching hits and assign a set number. Once all the dimensions have been created, one can request the intersection: S S1 and S5 and S8, for instance, gets the intersection of sets 1, 5, and 8. The Dialog command DS displays set numbers if the researcher forgets.
3. The third step is usually to filter the large number of hits one is apt to receive. For instance, one may limit hits to keywords appearing in the article titles. If S15 is the desired intersection, then the command "S S15 and public/TI" (without quotes) would give only the intersection hits in which the term "public" appears in the title. One can also limit by publication year: "S S15 and PY=1995:PY=1999" (without quotes) gets only hits between 1995 and 1999.

4. The fourth step is to print out one's hits. Each version of Telnet differs somewhat, but there is always a menu choice along the lines of "Start logging." This choice will allow the researcher to specify a directory and file name under which to save the hits one is about to list. After logging is turned on, everything that appears on the screen will also go into the file, which will be a plain ASCII text file. If the final set is S17, then it can be listed by the "T" type command: "T S15/5/all" (no quotes). There are three parameters: the set number, S15; the format, described on the Blue Sheets (5 is almost always "full format" and gives the most information; other formats may leave out the abstract, the descriptors, or other elements; KWIC can also be used in place of the 5 to get keyword-in-context listings); "all" specifies which records should be printed (one may also enter a numeric range, such as 1-25 for the first 25 records, which tend to be the 25 matching records most recently entered into the database). If a bibliographic database manager such as ProCite is used, the type command may also need the added term "TAG" at the end of the line. This adds tags such as "AU=" for the author component of the record, helping the database manager read in the downloaded records.
5. The fifth step is to log off. It is important that the researcher select "Stop Logging" or equivalent from his or her Telnet software, to close the logging file. In Dialog one then simply enters the command term LOGOFF.

There are, of course, numerous other options in the Dialog system. For instance, one can get an online explanation of any command by typing the command "HELP" followed by the command word of interest (e.g.: HELP TYPE). RANK DE will give a ranked list of descriptor terms for the current set of hits. The command EXPAND can be used with descriptor terms to generate additional potential keywords. EXPAND ROBBERY, for instance, will generate a list of keywords related to "robbery," assuming "robbery" is a descriptor for the current database. RD will remove duplicates prior to using the "T" command to display the records.

Other Paths to Online Bibliographic Research

ERIC. Perhaps the leading free online bibliographic resource is ERIC, the Educational Resources Information Clearinghouse. Though funded by the US Department of Education and having some focus in this area, ERIC is a general-purpose bibliographic search engine with broad coverage of current events and social sciences topics. The ERIC search engine works like most others, accepting keywords and returning citations. It is located at the web address http://ericir.syr.edu/Eric/. Documentation is located at http://ericir.syr.edu/Eric/plweb_faq.html.

LOC. The Library of Congress Search System gives access to citations on nearly every book ever published in the United States, and to many foreign works. It is located at the URL http://lcweb2.loc.gov/ammem/booksquery.html. Once there, one searches for books in the usual keyword manner, but a useful feature is that after finding a "hit," there is a "Browse the Shelf" button that gives access to adjacent titles in Dewey Decimal System library order so that one may seek additional titles, much as many researchers do in manual library research.

Amazon.com is a good source for online searching of books in print, available at http://www.amazon.com/. In some cases, reviews are also available.

Bartlett's Quotations is searchable online at http://www.columbia.edu/acis/bartleby/bartlett/.

City Net provides a wide variety of general information about major metropolitan areas, including maps, located at http://www.city.net.

The Electronic Newsstand, at http://www.enews.com/, links to over 2,000 online periodical sites. See also the Electronic Newspapers and Media page of the Yahoo search service, at http://www.yahoo.com/news_and_media/.

The Federal Web Locator is a major search service for federal governmental websites, located at http://www.law.vill.edu/fed-agency/fedwebloc.html.

The Internet Public Library, run by the University of Michigan, is at http://ipl.sils.umich.edu/ref/. Here one may pose questions to a virtual librarian, as well as browse the Ready Reference Collection.

Leading Political Science Sites is an extensive collection of website links, maintained by the author. It is located at http://hcl.chass.ncsu.edu/garson/burns/leading.htm. Click on "Bureacracy," "Public Policy," and "Federalism" chapters for public administration, public policy, and state government topics, respectively.

Research-it at http://www.itools.com/research-it/research-it.html contains a general-purpose collection including a dictionary, thesaurus, translators, language tools, biographical dictionary, Bartlett's Quotations, maps, CIA Factbook, telephone directories, financial tools, zip codes, listservs lists, and more.

Time-Warner Pathfinder at http://pathfinder.com provides searching for CNN, AllPolitics, *Time, Life, Money, Fortune,* and more.

US Government Information Resources is an online collection of web links located at http://www.nttc.edu/gov_res.html.

How to Cite Documents Found on the Web

There are a variety of suggested citation styles for Internet information. One is found at the Library of Congress web site at http://lcweb2.loc.gov/ammem/ndlpedu/cite.html. Another is found at the Internet Law web site at http://www.ipl.org/ref/QUE/FARQ/netciteFARQ.html. Specifically for users of public administration materials, the Bureau of the Census has provided one widely-used format, which is recommended below.

For web pages, including ASCII text or PostScript document format (PDF) files, the Census recommended format is as follows:

> *Author (last name, first name), if applicable, followed by "US Census Bureau"; within quotation marks, title of agency source or output/work, and/or html title (if different from the previous title); if available, the publication/issue/release (or "last revised") date, e.g., "published 27 December 1996;" universal resource locator (URL) of the tile page, if applicable, or the page where cited material appears, set off by angle brackets ( ); if there is no visible publication date, one may note the date, within parenthesis, when the data were accessed, e.g., "(accessed: 7 January 1997)." Semicolons are used to separate elements.*

Examples:

Citing a web page: US Census Bureau; "Advance Data from the Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations—First Quarter 1993;" published June 1993, <http://www.census.gov/agfs/qfr/view/qfr931mg.txt>.

Citing a specific table: US Census Bureau; "The Foreign-Born Population, (Table) 1. Selected Characteristics of the Population by Citizenship: 1994;" published 4 October 1996; <http://www.census.gov/population/www/socdemo/foreign.html>

Citing a .pdf file: US Census Bureau; Population Projections of the United States by Age, Sex, and Hispanic Origin: 1995 to 2050; <http://www.census.gov/prod/www/titles.html#popest>; (accessed: 10 January 1997)

On the web, there is a difference between static pages discussed above and dynamically generated pages. Dynamically generated tables and files do not exist as a specific URL address but are created "on the fly" in response to a user completing a web-based form. For dynamic pages, the Census-recommended format is as follows:

> *Name of agency; name of the database or other data repository/ source (e.g., Data Access and Dissemination System [DADS], Survey of Income and Program Participation [SIPP], TIGER Mapping Service, etc.), set off by quotation marks, or follow publication citation style; the name of the person who generates the extraction, tabulation, etc., e.g., "generated by John Smith;" the name of the software package used to generate the extract, tabulation, etc., if known, e.g., "using Data Extraction System;" the URL of the application software's main or first page set off by angle brackets, e.g., <http://www.census.gov/des/p1>; the date, within parenthesis, when the user generated the extract, tabulation, etc., e.g., (7 January 1997). Again, semicolons are used to separate elements.*

Examples:
US Census Bureau; "1990 Census of Population and Housing, Summary Tape File 3A;" generated by John Smith; using 1990 Census Lookup; <http://venus.census.gov/cdrom/lookup>; (12 February 1997).

A third type of citation is represented by file transfer protocol (FTP) files, which are simply files residing on a remote computer, such as a file server belonging to the Census Bureau. These files are normally downloaded to the user's computer and may not be viewed with a web browser at all. This is the recommended format for FTP files.

> *US Census Bureau; filename, e.g., "stp222.06;" file date, if available, e.g., "published 10 January 1997;" universal resource locator (URL), set off by angle brackets ( ), of page where cited material appears, e.g., <ftp://ftp.census.gov/housing>; if no file date found, the date, within parenthesis, when the user accessed the data, e.g.: (accessed: 7 January 1997). Semicolons separate elements.*

Examples:
US Census Bureau; stp222.06; <ftp://ftp.census.gov/housing>; (accessed: 7 January 1997).

U.S. Census Bureau; M20a9611.wk1; published 7 January 1997; <ftp://www.census.gov/pub/industry/M20a9611.txt>.

E-mail is a fourth and final type of citation, where the format is:

Message author's name (last name, first name, middle initial), e.g., "Smith, John T."; words "personal e-mail"; name of agency; subject from subject line of e-mail message, e.g., subject: "fertility statistics;" date e-mail sent, e.g., "7 January 1997." Semicolons separate elements.

Example:
Smith, John T.; personal e-mail; U.S. Census Bureau; subject: fertility statistics; 7 January 1997.

KEEPING UP

Although this essay seeks to constitute an overview of online research in public administration, providing good beginning points, the online world is constantly changing an expanding. Fortunately, there are a variety of ways of continuously updating one's online research skills.

The Government Information Sharing Project is an electronic mailing list sponsored by Oregon State University Information Services. It specializes in providing users with links and information on updates and additions related to public administration data. The list includes notices of what is listed in its "What's New" page and only includes information sent to the list by the staff of the Government Information Sharing Project. That is, it is an open list for purposes of announcement list, but it is not an open discussion list. One joins the list in the conventional way: send e-mail to listserv@mail.orst.edu with nothing in the "Subject:" line and in the body of the message put GOVINFO firstname lastname.

Government-oriented publications which specialize in information technology are another way to staying current with what is new online. Two leading examples are *Government Computer News* (http://www.gcn.com/) and *Government Technology* (http://www.govtech.net/).

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Innovation of Management Accounting Practices and Techniques

Davood Askarany, The University of Auckland, New Zealand

INTRODUCTION

This article is intended to help us document the innovation, evolution and the adoption of a variety of relatively new management accounting techniques and practices in organisations. In doing so, the article first reviews the introduction of management accounting techniques of the past few decades in the literature and then investigates their implementations in practice. Exploring the levels of organizational satisfactions with adopted management accounting innovations in practice, the article finally discusses tie level of associations between the adoption of management accounting innovations and organisational satisfaction.

BACKGROUND

The main focus of this article is on management accounting practices and techniques rather than managerial tools. There is no universal

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Information acquisition and management has always had a profound impact on societal and organizational progression. However, as computing dramatically advances the level of intelligence associated with management technologies, the breadth of their dispersal, and ultimately the impact of the information itself, the utilization and management of information science and technology also gains profound importance. This change-driven environment creates a critical need for a comprehensive, up-to-date reference encompassing the full range of concepts, issues, methods, technologies, and trends associated with the field.

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